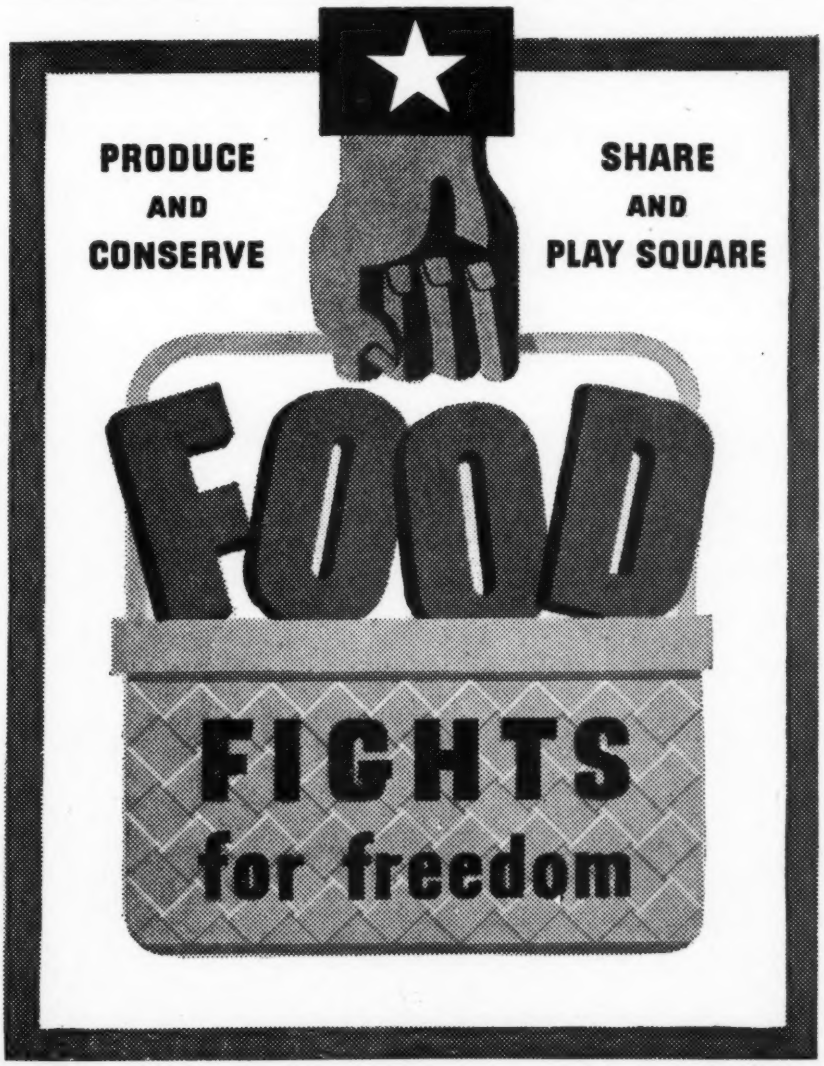
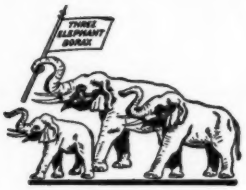
Better Crops with PLANT FOOD

November 1943 10 Cents



The Pocket Book of Agriculture

For Boron Deficiencies



THREE ELEPHANT BORAX

WITH every growing season, more and more evidence of *boron* deficiency is identified. Crops where lack of this important secondary plant food is causing serious inroads on yield and quality include alfalfa, apples, beets, turnips, celery, and cauliflower.

THREE ELEPHANT BORAX will supply the needed boron. It can be obtained from:

American Cyanamid & Chemical Corp., Baltimore, Md.

Arnold Hoffman & Co., Providence, R. I., Philadelphia, Pa.

Braun Corporation, Los Angeles, Calif.

A. Daigger & Co., Chicago, Ill.

Detroit Soda Products Co., Wyandotte, Mich.

Florida Agricultural Supply Co., Jacksonville and Orlando, Fla.

Hamblet & Hayes Co., Peabody, Mass.

The O. Hommel Co., Pittsburgh, Pa.

Innis Speiden & Co., New York City and Gloversville, N. Y.

Kraft Chemical Co., Inc., Chicago, Ill.

W. B. Lawson, Inc., Cleveland, Ohio

Marble-Nye Co. Boston and Worcester, Mass.

Thompson Hayward Chemical Co., Kansas City, Mo., St. Louis, Mo., Houston, Tex., New Orleans, La., Memphis, Tenn., Minneapolis, Minn.

Wilson & Geo. Meyer & Co., San Francisco, Calif., Seattle, Wash.

Additional Stocks at Canton, Ohio, Norfolk, Va., Greenville, Tenn., Nashville, Tenn., Wilmington, N. C., and Charlotte, N. C.

IN CANADA:

St. Lawrence Chemical Co., Ltd., Montreal, Que., Toronto, Ont.

Information and Agricultural Boron References sent free on request. Write Direct to:

AMERICAN POTASH & CHEMICAL CORPORATION

122 EAST 42nd ST. NEW YORK CITY

Pioneer Producers of Muriate of Potash in America

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXVII NUMBER 9

TABLE OF CONTENTS, NOVEMBER, 1943

Antidotes 3
Suggested by Jeff, If You Need Them

How Rotation Paid in North Carolina 6
As Reported by Enos C. Blair

Put It On—Not Off 8
Is the Advice of Glennon Loyd

The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil 9
Discussed by Dr. W. H. MacIntire

Mississippi Farmers Improve Their Soils 13
Fred J. Hurst Tells How

Maintaining Available Potassium in Soils 19
Explained by R. E. Stephenson

Kudzu Conserves Southern Soils 21
Observed & Illustrated by R. Y. Bailey

The American Potash Institute, Inc.

1155 16th Street, N. W., Washington 6, D. C.

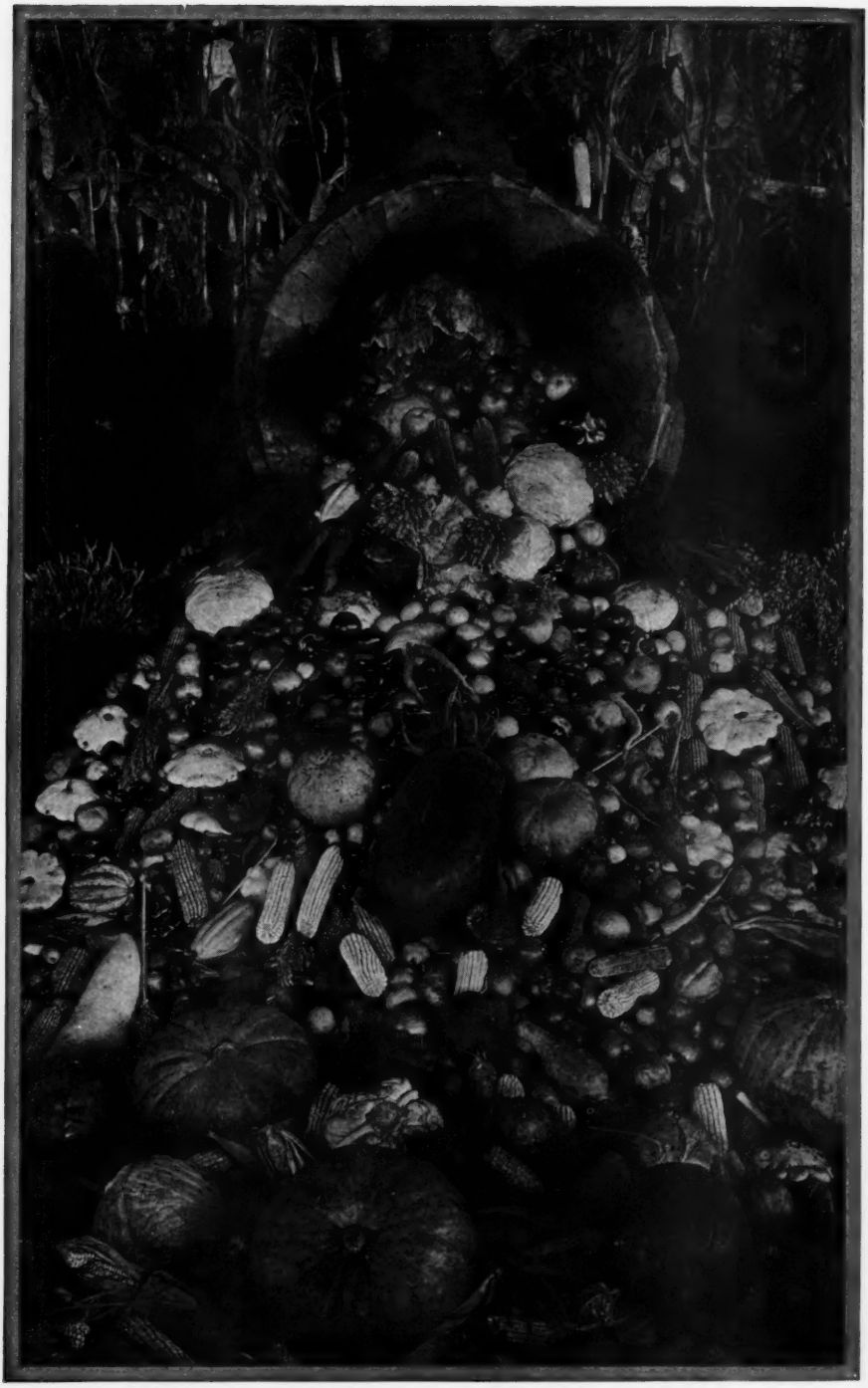
Member Companies: American Potash & Chemical Corporation
United States Potash Company
Potash Company of America

Washington Staff

J. W. TURRENTINE, *President*
J. D. Romaine, *Chief Agronomist*
R. H. Stinchfield, *Publicity*
E. L. Ingraham, *Motion Pictures*
Mrs. C. M. Schmidt, *Librarian*

Branch Managers

S. D. Gray, *Washington, D. C.*
H. B. Mann, *Atlanta, Ga.*
G. N. Hoffer, *Lafayette, Ind.*
M. E. McCollam, *San Jose, Calif.*
E. K. Hampson, *Hamilton, Ont.*



Again, We Give Thanks

Better Crops with PLANT FOOD

PUBLISHED BY THE AMERICAN POTASH INSTITUTE, INC., 1155 SIXTEENTH STREET, N.W., WASHINGTON 6, D. C., SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10¢ PER COPY. COPYRIGHT, 1943, BY THE AMERICAN POTASH INSTITUTE, INC.

VOL. XXVII WASHINGTON, D. C., NOVEMBER, 1943 No. 9

Often worse than the poison, are—

Antidotes

Jeff McDermid

"STRAIN EASERS" of the non-alcoholic variety is my theme this time, inasmuch as taxing, rationing, war frenzy, and the stern task of making everything over fresh to sound as though it were vital to victory—they all sound trite sometimes, and only fix the wrinkles a little deeper.

In fact, I am certain that the Yankee invaders of New Georgia jungles and Sicilian mountains are jollier and less lugubrious on the whole than many of us watchers and waiters at home.

One of the most torturing tasks we have assumed since P. H. is the one of overworking our frayed imaginations to twist ordinary everyday jobs (or things we don't wish to sacrifice) into potent weapons to insure success for the United Nations. Commerce also has seized upon it, advertisers have blazoned it abroad, and groups and individuals vie in trying to coin the cutest phrases geared to guns and to methods of destruction.

I do not suppose there has been another era quite like it in any land, where mental effort has been so far bent over to link production with destruction, and to find some crumb of connection somewhere between a man's favorite job or pastime and the national task of armed victory. It has become a fetish and we might as well regard it tolerantly just for the passing moment, trusting to our natural reactions to iron it all out into constructive, less

tortuous paths when peacetime comes. That's the philosophical way anyhow, and mere dull preachment would fall on barren ground.

Any magazine will prove the way salesmanship has become imbued with the Number One job of war-winning. Maybe it's the real reason we are winning, and if so, more power to the press.

We learn that Tusklustre tooth paste is necessary to make soldiers on leave welcome to their gals, or to make our jaws withstand the rigors of rationed substitutes for yet a little longer without taxing the depleted stocks of dentists and molar extractors, who are sadly needed in the army, or for making false sets for conquered natives to chew our lend-lease tidbits.

WE hear that the new No-Jag can opener will save lady fingers from bruising so they can devote their time to knitting; that bobby pins are factors in making the canteen hostess help the private forget the sergeant; that nothing but super-bond, deckle-edge stationery is acceptable in Burma; and that it's better to let your whiskers grow without using Keen-slasher blades, than it is to try to buy them in competition with the army.

We sell ourselves and our cronies to the idea that the old country club must be kept going in memory of the caddies who are now toting ammunition and hearing worse language than the links provided. The chummy old poker gang that meets regular every week must stick together so they can give returning card sharks fresh from Monte Carlo a fairly good evening. And then we must keep the fairs and carnivals going as usual, provided all the crop and livestock exhibits are placarded with food - for - freedom - we - feed -'em slogans; and the dancing girls kick the hat off "Hitler" as a grand finale.

But to me it's queer why we don't come right out and admit that we ignore Mister Eastman and encourage travel to fairs just to get the gate receipts and let everybody relax and have a heck of a foolish time, as an antidote for war. We might as well confess that's our objective, along with the side issue of keeping a few chaps in their accustomed entertainment and purveying jobs.

Of course, last month they stuck on a gasoline limitation like a cold wet blanket across the midways and stock rings of the fair-loving midwest, which may hamstring some of the fun-as-usual gentry. But I doubt if that will crimp some of our most confirmed county fair addicts, who got the habit back when they loaded up a lumber wagon to cart the whole community into the county seat for a jamboree. It may go hard with some of the super-duper shows in the urban-expo class to locate enough rubes willing to lay off long enough to come in and show off their bulls and mangel wurzels. But still and all, I predict that the weather man will continue to be the main reason for the success or fizzle of our fairs.

I ALSO bank on the mountebank. He never fails us. If there are any still frisking the yokel belt during an era when the old shell game does so well in the army, then we'll witness more of their protean performances. These talented pitch men are often forbidden to open their mysterious valises on some of our most censored show grounds, but even a boom-voiced congressman seeking re-election on a no-subsidy platform cannot begin to assemble the crowds that our unabashed carnival mountebank can collect in five minutes. Listening to such superb, nonchalant bravado as these swashbucklers unload is a real support to my sometimes jaded interest. In this period when valuable merchandise is hard to get in an honest, over-the-counter transaction, the wonderful sangfroid of these wandering pitch men in disposing of worthless glass diamonds, rheumatiz salve, and carbuncle cure through the mere power of eloquence stands to me as a symbol of the old unchanging American spirit. I

resent the blustering paternalistic fair manager who tries to shoo away those fellows at a time when we (or some of us) are earning so much more than usual, and find it hard to spend it legitimately. Verily the mountebank is a bringer-of-balm to a weary world, so let's place him securely among my quickest antidotes.

Similarly, in the same class of necessary evils today, I mention the guy who

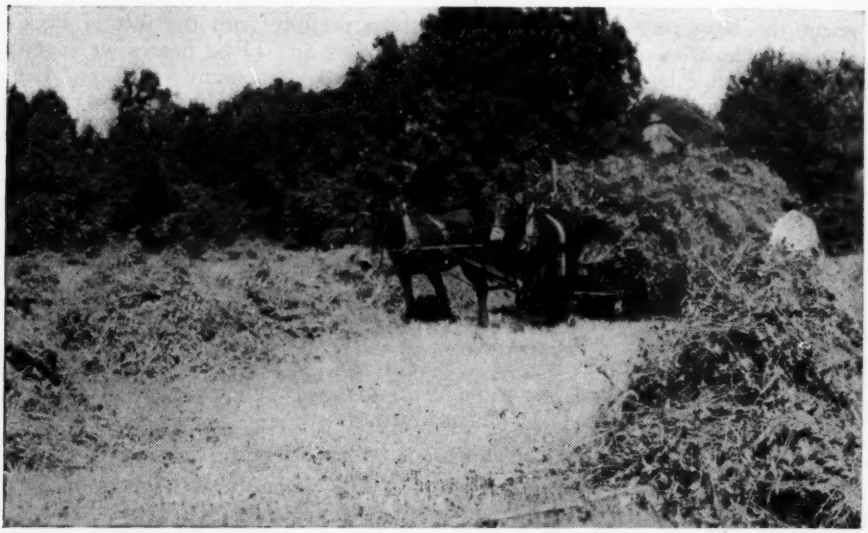
gets your dime for a paperful of messy floss candy, with which one can disfigure a face and begrime a shirt front in a twinkle. Likewise, at the fairs let our praise be sung to the leather-lunged purveyor of those little sausages which seem to be tinted with barn paint; and the cane ringer and guess-your-weight fellow, and I am even ready to be soaked again for another glimpse of the only original embalmed mummy of the decidedly late John Wilkes Booth. I shall welcome the fat lady, envy the sword swallower, buy photos of the Indiana moron dubbed the Wild Man of Borneo, and get right into the front row for those Queens of Cairo (Illinois). All these fair-time fancies keep me from cogitating too deeply on the fate of myself and others in the post-war world.

Of course, one can remain at home on Sundays and invest in the somewhat reduced tonnage of the newspapers, in which one can bank on plenty of stultified and goofy articles and illustrated features to provide a temporary mental void. If they fail me, I can turn to the alleged comic sections and compare them ruefully with the sort of Peck's Bad Boy and Hobo heroes we eagerly depended upon many years ago. Legendary wonder workers, knight errants, and supermen with marvelous pen and ink scenic backgrounds did not grace our original funny papers. We took life in the raw in those days, and the Mauds with mighty hoofs, the Hooligans and the Katzenjammers who risked life and limb and broke up family relationships just to tickle the small boy are for the most part gone for good. But not the power of the press to hold its juvenile audience—that remains as firm as ever.

WITNESS for yourself, by going into any canteen where the service men assemble for relaxation. Do they want high-geared mental stimulation, or do they ask for the multi-colored marvel sheets? The ayes have it. It's the latter nine to one. I have seen them so absorbed in the adventures of Flash Gordon or some of the sky-riding, death-ray geniuses that they even forgot to listen for the mess call. Time was when I thought the funnies were merely a handy way for me to keep the kids out of mischief while Ma washed the dishes after a Sunday repast—when I managed to keep awake long enough to conduct them word by word through the escapades of the comic characters. It seems that this early home training has had a solid and far-reaching effect. If these kids who are now shouldering arms and bearing the burdens of past mistakes could vote on the contents of Sunday papers, the dauby sheets would prevail and editorial ponderosity would vanish.

As another form of relaxation from war worries I can get real mad about it in a professional way. That is, being myself a purveyor and a scribbler of serious uplift articles in an agricultural periodical, I can get very disagreeable and caustic about the huge tonnages of pulp wood that go into tinted comic books instead of being added to the quota of regulation news print. Yet

(*Turn to page* 49)



Harvesting soybean hay on the Fryar Farm, Greensboro, North Carolina. Yield, over 3 tons per acre.

How Rotation Paid In North Carolina

By Enos C. Blair

Extension Agronomist, N. C. State College, Raleigh, N. C.

MAX FRYAR, a farmer near Greensboro, North Carolina, has trebled crop yields on his farm during the past 10 years. He has succeeded in this by doing two things—by adhering strictly to a definite soil-building rotation of crops, and by practising a wise system of fertilization.

It was on a February day in 1934 that the writer and County Agent J. I. Wagoner walked over the Fryar farm and planned the rotation that Max has since been following. The four-year rotation runs like this:

1st year: Jarvis Prolific corn.

2nd year: Otootan soybeans for hay.

3rd year: Small grain (wheat or oats) followed by Korean lespedeza for seed.

4th year: Korean lespedeza for seed.

Four fields of about eight acres each were laid off for the rotation. Additional land was set aside for tobacco and small grain, and for permanent pasture.

At that time the Fryar farm was not producing yields above the average for the community. Corn produced 20 bushels per acre, soybeans 1 ton of hay, and wheat 11 bushels. In 1938 the corn yield had climbed to 42 bushels, that of soybean hay to 2 tons, and the wheat yield to 17 bushels per acre.

Four years later, in 1942, yields were still higher. Corn made 53 bushels per acre, soybeans 3¼ tons of hay, and wheat 23 bushels. A new crop had been added, the lespedeza was combined and made a yield of 660 pounds of seed per acre.

However, many a farmer rotates his crops and even grows legumes in his rotation, but still meets with little success because he does not feed his soil. Legumes can be soil-builders or soil-robbers, depending on how they are handled. The chief secret of Max Fryar's success is that he has always made his lespedeza perform the work of a soil-builder. Before combines came into the community, the lespedeza was simply turned under. Now the seed is combined, making a very profitable cash crop, and all roughage is turned under as before.

Above: Corn on the Fryar Farm in 1942. Yield 53 bushels per acre.

Below: Corn on farm adjoining in 1942. Yield about 20 bushels per acre. The Fryar Farm was formerly a part of this farm.

This is done in the fall, so that the large clods have time to freeze and pulverize, and the lespedeza stalks to decay, before corn is planted. The soil is one of the Iredell types, having a gravelly but somewhat sticky topsoil, and a very tight and sticky subsoil, known locally as "bull-tallow." Freezing, thawing, and the incorporation of organic matter make this almost impossible soil easy to till.

No cover crop is planted after the corn crop. The soil is plowed again during the winter, allowed to freeze, and planted to soybeans the following spring. The soybean hay crop is recognized for what it is, a soil-depleting crop. However, it comes off early, and leaves the land in such shape that a good seedbed is easily prepared for wheat or oats.

The small grain is drilled in early, and for that reason gets a much better start than when planted after corn or cotton.

Lespedeza is sown on the small grain in March, with a grain drill, and grows on the field for two years. It is then turned under for corn, completing the cycle.

Max Fryar has also learned to use commercial fertilizers to much better advantage than formerly. In 1934 he was fertilizing his crops, now he fertilizes his rotation.

For instance, prior to 1934 his fertilizer application for corn and wheat was 200 lbs. of 3-8-3 per acre. This was changed to 200 lbs. of 3-10-6 at the beginning of the rotation. Later, as heavier crops of legumes were grown, the need for more potash was felt and the application was changed again, this time to 200 lbs. of 3-10-10.

But for the past several years, fertilization has been made to fit the rotation. Since the yields of all other crops are dependent on that of lespedeza, the first essential is to insure as big a growth of that crop as possible.

This is done by feeding it with one ton of ground limestone, and 200 lbs. of 48 per cent superphosphate per acre. The lime and half the phosphate are applied in the fall before sowing small grain, about five months before the lespedeza is sown. The rest of the phosphate is drilled in with the lespedeza seed. This results in an enormous growth of lespedeza, which is turned under. It also makes nominal amounts

(*Turn to page* 47)

Chan H. Harreld, Marion, Indiana, farmer in alfalfa field that yielded 6 tons per acre in 1942. (Photo taken after first cutting, 1943).

Put It On—Not Off

By Glennon Loyd

Soil Conservation Service, U. S. Department of Agriculture, Milwaukee, Wisconsin

COMING down the gravel highway, one of Chan H. Harreld's neighbors spotted him in a sloping field doing the "strange" thing of planting corn on the contour. Watching the "crazy antics," the neighbor craned his neck too long and the car he was driving left the road and crashed into Harreld's fence.

At that time Harreld, whose 80-acre farm is two miles north of Marion, Indiana, was one of the first farmers in Grant county to take up soil conservation farming. The fence hasn't had another shock resembling that one of a few years ago; but the roadside field, now in alfalfa, again is attracting attention and promoting a lot of comment in the community—and justifiably so. It is the field from which Harreld cut six tons of excellent alfalfa hay last year. He makes three plants grow where most farmers are content with only one. He harvests three times as much alfalfa from an acre as most farmers do.

Harreld, with his leathery cheeks and thick shock of gray hair, appears to be a fellow with an understanding of the soil and an appreciation of nature's processes. You need only to visit with him a few minutes till his soft-spoken sincerity convinces you that he is just that type of farmer.

As we were inspecting his alfalfa field after the first cutting this year, Harreld explained that it was his duty to see that his soil is as well fed as himself. "And I think the Missus has done

(*Turn to page* 43)

The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil

By Dr. W. H. MacIntire

Tennessee Experiment Station, Knoxville, Tennessee

FOR many years it has been taught that liming causes the native supplies of potassium in the soil to become more available to plant growth through direct chemical changes. This teaching came largely as an interpretation of laboratory results into terms of what transpires in soils under field conditions. It is true that a laboratory suspension of an acidic soil in a solution of neutral salts of calcium and magnesia will bring about the release of some potassium. But, the extent of this release falls far short of the potential liberative capacity of the neutral salts, even under the intensified conditions imposed in the laboratory suspensions. Moreover, the intensity of the laboratory conditions, including concentration of the neutral salt solution, would not be attained in the soils of the field. Since the formation of calcium and magnesium salts is promoted as a result of bacterial activation in limed soils, it was concluded that these generated neutral salts would induce a liberation of soil potassium under field conditions. That conclusion has not been proved.

The present discussion deals with a 26-year accumulation of evidence that points to the opposite conclusion. The results given represent lysimeter findings obtained by the analyses of the rainwater leachings from an annual precipitation of 51 inches at the Tennessee Experiment Station. It is emphasized that the content of the free soil-water can be taken as an index of the nutrient content that will be taken up by plants grown in soil under similar treatment and conditions. The plant acquires its nutrients from the source that offers the least resistance. That is, the plant follows a natural bent and obtains its mineral nutrients by the expenditure of the minimum of effort necessary to acquire them. If the nutrients are present in the dissolved state, the plant need not draw upon the solid materials of the soil. Therefore, the concentration of an element in the free soil-water will be reflected by a corresponding incidence of that element in the plant ash.

Experimental Results from Limings at Rational Rates

All of the experimental results will be expressed in terms of either potassium (K) or potassium oxide (K_2O) per 2,000,000 pounds of fallow soil. The data of table 1 give the amount of potassium leached from a fallow Cumberland silt loam soil over a 23-year period, subsequent to a single full-depth liming with four liming materials at the equivalent rate of one ton of burnt lime.

Each of the four liming materials caused a repression in the outgo of potassium in the leachings during the first 12 years, wherein the sole additive treatment was a single liming mate-

* A paper read at a Fertilizer Conference held in Nashville, Tenn., October 1941 and distributed in mimeograph copy to those in attendance by the Extension Service of The University of Tennessee.

TABLE 1—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF FALLOW SOIL

	Soil only	Lime-stone	Dol-omite	Burnt lime	MgO
Outgo during the first 12 years, no treatment other than liming	101	95	80	87	73
Outgo during next 11 years, with annual additions of 166 lbs. of K, as K_2SO_4	1138	988	983	965	1017

rial. An addition of 166 pounds of K was made at the beginning of each of the next 11 years. From this total addition of 1,826 pounds of K, a 1,138-pound recovery came from the unlimed soil. This recovery was substantially greater than that from each of the four liming materials. The persistence of the repressive effect exerted by each of the liming materials upon potassium outgo is evident, even after 12 years. Each residue of the four materials was still potent enough to diminish the concentration of potassium in the leachings, in spite of the large input of potassium sulfate during the last 11-year period.

capable of generating 4,250 pounds of calcium sulfate. Moreover, when the calcium sulfate was used jointly with burnt lime, or with an equivalence of burnt magnesia, any liberative tendency of the acidic ferrous sulfate was nullified and the repressive effect of these two liming materials was still definite. Moreover, the same order of results was indicated as an effect of the residue of the added burnt lime and burnt magnesia that remained after 12 years' exposure to rainwater. This effect of the residues of the liming treatments continued to show throughout the succeeding 11 years of the experiment, during which period annual additions

TABLE 2—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF FALLOW SOIL

	Soil only	$FeSO_4$ only	$FeSO_4$ + CaO	$FeSO_4$ + MgO
Outgo during the first 12 years, no treatment other than liming	101	99	74	79
Outgo during the next 11 years, with annual additions of 166 pounds of K, as K_2SO_4	1138	1130	994	964

The data given in table 2 were obtained from the same soil and experiment as in table 1. In this series, the single addition of ferrous sulfate was made alone and with lime and with magnesia in respective amounts capable of neutralizing the acidic iron salt and still supply an initial liming at the equivalent rate of 2,000 pounds of CaO.

The data of table 2 show that no definite release of potassium was obtained from the relatively small exchangeable K content of this soil as the effect of an amount of ferrous sulfate of 166 pounds of potassium were made in the form of potassium sulphate.

In table 3, the effect of a single 2-ton $CaCO_3$ addition of limestone, and that of a corresponding addition of dolomite, was registered by the amounts of K recovered from ten 229-pounds annual additions of K as potassium sulphate.

The data of table 3 show that limestone and dolomite caused a decrease in the potassium outgo from these 10 annual additions. Repressive effect upon leachability was registered by both

TABLE 3—AMOUNTS OF K LEACHED—LBS. PER 2,000,000 LBS. OF BROWN SILTY CLAY LOAM*

Soil only	Soil + K_2SO_4	Soil + K_2SO_4 + limestone	Soil + K_2SO_4 + dolomite
Outgo from 10 annual additions of 229 lbs. of K			
528	2102	1978	1971
Outgo from 10 annual additions of 458 lbs. of K			
528	3794	3682	3660

(* This soil was characterized by an unusually high content of exchangeable K, as a result of having been in sod for many years).

limestone and dolomite upon the 10 corresponding annual additions of potassium at the double rate of 458 pounds of K per acre per annum. These results demonstrate once more that the addition of liming materials tends to put into the soil a part of the added potassium salt, and that the soil retains some of this added potassium in a form less soluble in lined than in unlimed soil. Usually the K that is retained by the soil against leaching is greater percentagewise for a light addition, although the actual retention may be larger for heavier rates of K additions.

TABLE 4—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS OF K_2O TO AN ALKALINE JACKSON (CALHOUN) SOIL

	Lbs.	Net recovery Per cent
Soil only	76	.....
Soil + KNO_3	1288	61
" " + limestone	1190	56
" " + dolomite	1236	58
Soil + KCL	1220	58
" " + limestone	1195	56
" " + dolomite	1218	57
Soil + K_2SO_4	1271	60
" " + limestone	1237	58
" " + dolomite	1235	58

In another experiment with three soils of divergent characteristics, the additions of K were made in each of the three soluble forms—nitrate, chloride, and sulfate—with and without limestone and dolomite.

The data of table 4 show the amounts of potash, K_2O, recovered from 10 annual additions of 200 pounds of K_2O applied in each of the three forms to the Jackson or Calhoun soil, unlimed and limed with limestone and with dolomite at the constant rate of two tons of $CaCO_3$. The single liming treatment was a full-depth incorporation at the beginning of the experiment. This particular soil is naturally mildly alkaline, although it is neither a calcareous soil nor one high in natural supplies of non-carbonate calcium. The liming, therefore, did not bring about a condition or soil reaction opposite to that which prevailed in the unlimed soil at the beginning of the experiment. In each case, the amount of potassium leached from the unlimed soil exceeded that leached from its corresponding unit that had been limed.

TABLE 5—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS. OF K_2O TO HARTSELLS (CROSSVILLE) FINE SANDY LOAM

	Lbs.	Net recovery Per cent
Soil only	170	.....
Soil + KNO_3	1213	52
" " + limestone	864	35
" " + dolomite	952	39
Soil + KCl	1246	54
" " + limestone	946	39
" " + dolomite	1008	42
Soil + K_2SO_4	1331	58
" " + limestone	1009	42
" " + dolomite	1086	46

TABLE 6—AMOUNTS OF K_2O LEACHED FROM 10 ANNUAL ADDITIONS OF 200 LBS. OF K_2O TO CUMBERLAND SILT LOAM

	Lbs.	Net recovery Per cent
Soil only	221	.....
Soil + KNO_3	1507	64
" " + limestone	980	49
" " + dolomite	1283	53
Soil + KCL	1526	65
" " + limestone	1526	52
" " + dolomite	1177	59
Soil + K_2SO_4	1652	72
" " + limestone	1338	56
" " + dolomite	1389	58
Soil + $K_2SO_4 \times 4$	5710	98
Soil + $K_2SO_4 \times 4$ + limestone	5331	91
Soil + $K_2SO_4 \times 4$ + dolomite	5507	94

Nevertheless, the effect of the liming treatment upon potassium retention was not so extensive, nor so definite as that registered by the liming treatments upon acidic soils. This will be seen from the values given for the net recoveries from the three potassium salts on two acidic soils of the same experiment, in relation to the 10-year recoveries from those units that were limed with either limestone or dolomite at the beginning of the experiment.

The potassium recoveries shown in table 5 were obtained from the Crossville or Hartsells fine sandy loam, in parallel with the results shown in tables 4 and 6. The Hartsells soil is decidedly acidic, and the additions of the limestone and dolomite exerted a substantial repressive effect upon the outgo of the potassium added as either nitrate, chloride, or sulfate.

The data in table 6 were obtained from a Cumberland silt loam, in parallel with the results from the other two soils, as given in tables 4 and 5.

In the case of the Cumberland silt loam of table 6, however, an additional multiple-rate potassium treatment was included in the experiment, the sulfate of potassium treatment being used at a rate four times the standard rate of 200 pounds of K_2O per annum for a 10-year period. The soil had ceased to retain any appreciable quantity of potassium after seven of the 4-fold treatments, and the additions then were discontinued. In every comparison for each of the three potassic salts, the limestone and the dolomite served to diminish the outgo of the added potassium below the amount leached from the corresponding addition to the unlimed soil.

(*Turn to page* 45)

TABLE 7—POUNDS OF K LEACHED PER 2,000,000 POUNDS OF A CUMBERLAND SILT LOAM INFLUENCED BY SEVEN LIMING MATERIALS—INCORPORATED AS 32-TON CaO—EQUIVALENT TREATMENTS*

	Disparities between the 26-year outgo of K from the untreated soil and the outgo from the same soil limed with						
	Burnt lime	Magnesia	Pptd. $CaCO_3$	Pptd. $MgCO_3$	Limestone	Dolomite	Magnesite
Disparity in the outgo from the surface soil	76	130	99	126	112	130	141
Disparity in the outgo from the surface soil and one foot of subsoil	161	194	172	216	187	186	192

(* Similar values were obtained by the use of the same seven materials at the rates of 8-ton and 100-ton CaO equivalence.)

Bur clover is widely grown as a winter cover and soil-building crop.

Mississippi Farmers Improve Their Soils

By Fred J. Hurst

MISSISSIPPI farmers are making big strides in establishing a better balanced and more productive system of farming. They are conserving and improving soil fertility. They are increasing per-acre yields and total production of farm crops. They are improving permanent pastures. They are raising more livestock. They are increasing farm income from both crops and livestock.

Adjustments in crop acreage, a shift from soil-depleting crops to soil-conserving crops, the carrying out of soil-building practices, the improvement of permanent pastures, and the application of mineral fertilizers have been the chief means used to conserve and restore soil fertility and increase farm production. The improvement of farm income has been due to increased production and the higher prices received for farm products.

In 1932, the year before the AAA farm program was inaugurated, Mississippi farm cash income totaled $55,379,000. By 1941, the State's cash income had climbed to $220,679,000.

In 1942, when the war sharply increased the demand for farm products and farm prices just about reached parity, Mississippi farm income jumped to $322,857,000, a gain of $267,478,000 over the disastrously low return in 1932 which hit agriculture such a staggering blow.

Austrian winter peas on the farm of C. V. Maxwell, Pickens, Mississippi. This check plot received 500 lbs. basic slag.

Farmers must not only produce economically. They must sell profitably. In 1932, the price of cotton dropped to 5 cents a pound, hogs brought less than $3.50 a hundred pounds, and wheat sold for 30 cents a bushel. Although the farm population made up about one-fourth of the national total, the American farmers' share of the national income had declined from a peak of 21 per cent in 1919 to 5.7 per cent in 1932.

This paralyzing blow to agriculture shook the economic foundations of the nation. As farm purchasing power declined, the entire country was affected. Thousands of farms were sold to satisfy mortgages and pay taxes. Business enterprises went bankrupt. Banks failed. Factories closed. Unemployment increased. Breadlines formed in the cities. The farm problem had become the city problem too.

Something had to be done. Congress passed the AAA Act early in 1933, and the adjustment program was inaugurated to deal with farm surpluses, conserve soil fertility, improve farm family living, and increase farm income.

Farmers then began to build the type of program that was to stand the nation in good stead when war came. Huge supplies of corn, cotton, wheat, and tobacco were stored up under the loan provisions of the AAA during years of high production and low prices and provided a great storehouse of critically needed supplies when the country was plunged into war. Farmers carried out soil-building practices in peace time to store up fertility for increased production in war time.

Mississippi farmers have carried on a veritable crusade against erosion. During the seven years the agricultural conservation program has been in operation, they have built 236,375,549 feet of terraces, applied 84,526 tons of superphosphate and put out 60,828 tons of limestone on legumes and permanent pastures, seeded 6,084,225 acres to legumes, plowed under a grand total of 13,906,275 acres of green manure crops, seeded 226,954 acres of pasture, and constructed 2,062,914 feet of permanent waterways.

Mississippi farmers annually have shifted around 1½ million acres from production of soil-depleting crops to the production of soil-conserving and feed-producing crops. This shift of 1½ million acres to food and feed production provided a more abundant living for farm families and laid the foundation for a rapid expansion in livestock farming.

Amazing farm gains have been made in farm production. During the 1928-

This plot of Austrian winter peas on Mr. Maxwell's farm received 100 lbs. muriate of potash 60% in addition to the 500 lbs. of basic slag.

32 five-year period before the AAA program was inaugurated, Mississippi produced an average of 1,559,000 bales of cotton on approximately 4,000,000 acres of land. During the past 10 years, Mississippi has produced an average of 1,616,000 bales of cotton on 2½ million acres of land. During the past seven years in which the agricultural conservation program has been in operation, Mississippi has averaged 1,881,-285 bales, an increase of 242,285 bales a year on 1½ million acres less land.

This remarkable gain has been accomplished by increasing the per-acre yield of cotton from 188 pounds per acre for the 1928-32 pre-AAA five-year period to 317 pounds per acre during the past seven years and 395 pounds in 1942.

But production of more cotton on less land is only one phase of the story. Corn production has been increased 15,000,000 to 16,000,000 bushels annually.

Production of hay has been more than doubled, increasing from an average of 497,000 tons for the 1928-32 period to 1,207,000 tons in 1941 and 1,073,000 tons in 1942.

Production of oats has been increased by more than 10 times, climbing from 837,000 bushels during the base period to 10,152,000 bushels in 1941 and 9,000,000 bushels in 1942.

Production of alfalfa hay was increased from an average of 60,000 tons in 1928-32 to 152,000 tons in 1942; production of lespedeza hay jumped from 80,000 tons to 330,000 tons; cowpea hay was increased from 80,000 to 165,000 tons; soybeans for seed climbed from 137,000 bushels to 2,842,000 bushels; cowpeas for seed were upped from 393,000 to 1,968,000 bushels.

The increase in production of feed and the improvement of permanent pastures have been followed by a rapid increase in production of livestock. Cash income from sales of cattle, hogs, milk, chickens and eggs, lambs and wool in 1942 totaled $52,252,000, or nearly as much as the total crop and livestock income in 1932.

Agricultural leaders are gratified over the fine progress farmers have made in soil-building and balanced farming. But they realize that if soil-building is to be continuous and permanent, many farmers in the future must include potash as well as lime and phosphate in their legume and pasture fertilizing program.

The production of legumes, if plowed under or left on the land to decay, adds humus and nitrogen to the soil and may make more of the phosphorus and

potash in the soil available. But legumes, even when plowed under, do not increase the total amount of calcium, phosphorus, and potash in the soil. These plant-food elements, deficient in many soils, must be added in the form of fertilizers to obtain satisfactory growth and yields of legumes and other crops.

From the very beginning, AAA officials emphasized the need of lime and phosphorus, especially on eroded and depleted soils, in the production of legumes and the improvement of pastures; and soil-building payments have been made to farmers for carrying out these practices.

Meantime, the results of agricultural research and farm experience pointed to the need of including potash in the soil-building program on many soils. In 1942 and 1943, the Mississippi AAA farm program included payments to farmers for the application of muriate of potash, or its equivalent, on permanent pasture, winter legumes, mixtures of winter legumes and small grain, lespedeza, crotalaria, Alyce clover, summer legumes grown and harvested for seed under specified conditions and limitations, and other summer legumes, (except soybeans for oil and peanuts) which are broadcast or close-drilled. As a result there has been a sharp increase in the use of potash under the designated crops during the past two years, and especially in 1943.

The wisdom of including potash in the soil-building program is shown in results obtained in numerous field tests conducted over the State in 1943 by county agents, soil conservation service technicians, and other agriculturists, as outlined in the following table:

DEMONSTRATION RESULTS—1943

NAME & ADDRESS of Farmer, Soil	Crop	FERTILIZER Treatment Lbs.	YIELD Gr. Wt. Per Acre–Lbs.
C. V. Maxwell, Pickens, Miss. Terrace soil	Vetch	500 Basic slag 500 Basic slag 100 Muriate of potash 60%	7,441.5 14,247.9
B. E. Presley, Pickens, Miss. Bottom land	Vetch for seed	250 Superphosphate 1,000 Lime 250 Superphosphate 1,000 Lime 100 Muriate 60%	9,256.5 23,958.0
J. M. Kimbrough, Lexington, Miss. Terrace soil	Wild Winter Peas	250 Superphosphate 250 Superphosphate 100 Muriate 60% 250 Superphosphate 300 Muriate 60%	5,445.0 9,692.1 13,939.2
Thompson & Carroll, Lexington, Miss. Hill land	Pasture Hop & Other Clovers.	250 Superphosphate 250 Superphosphate 100 Muriate 60%	11,761.2 14,697.1
Thompson & Carroll, Lexington, Miss. Terrace soil	Seed Field Hop & White Clovers.	250 Superphosphate 250 Superphosphate 100 Muriate 60%	8,712.0 13,721.4
H. P. Watson, Lexington, Miss. Terrace soil	White Dutch Clover Pasture	250 Superphosphate 500 Lime 250 Superphosphate 500 Lime 100 Muriate 60%	8,058.6 12,196.8

DEMONSTRATION RESULTS—1943

NAME & ADDRESS of Farmer, Soil	Crop	FERTILIZER Treatment Lbs.	YIELD Gr. Wt. Per Acre–Lbs.
B. E. Presley, Pickens, Miss. Terrace soil All clover died on check	Oats & White Clover plot	250 Superphosphate 1,000 Lime	11,761.2
		250 Superphosphate 1,000 Lime 100 Muriate 60%	26,136.0
B. E. Presley, Pickens, Miss. Terrace soil This crop was largely oa following.	Oats and Pasture Mixture ts—lespedeza	250 Superphosphate 1,000 Lime	13,068.0
		250 Superphosphate 1,000 Lime 100 Muriate 60%	24,829.2
R. M. Branch, Goodman, Miss. Terrace soil	Wild Winter Peas for seed	250 Superphosphate 500 Lime	5,227.2
		250 Superphosphate 500 Lime	11,325.6
R. M. Branch, Goodman, Miss. Terrace soil	Wild Winter Peas	250 Superphosphate 500 Lime	7,187.4
		250 Superphosphate 500 Lime 100 Muriate 60%	16,661.7
H. W. Vandiver, Cruger, Miss. Delta Foothills	Wild Peas Vetch (excellent crops)	No treatment 100 Muriate 60%	15,681.6 28,749.6
H. W. Vandiver, Cruger, Miss. Delta Foothills	White Dutch Clover	250 Superphosphate 500 Lime	6,425.1
		250 Superphosphate 500 Lime 100 Muriate 60%	10,454.4
W. H. Simpson, Winona, Miss. Botton land (branch)	Red Clover & Oats	600 Basic slag	7,949.7
		600 Basic slag 100 Muriate 60%	14,483.7
W. S. Pittman, Winona, Miss. Bottom land (Terrace)	Red Clover & Oats	500 Basic slag	18,404.1
		500 Basic slag 100 Muriate 60%	23,522.4
W. S. Pittman, Winona, Miss. Terrace soil	Vetch and Wild Winter Peas	500 Basic slag	11,107.8
		500 Basic slag 100 Muriate 60%	16,226.1
C. S. Hamer, Kilmichael, Miss. Hill land	Wild Winter Peas	500 Basic slag	16,988.4
		500 Basic slag 100 Muriate 60%	28,636.3

It is significant that in these 16 tests, production was more than doubled in four tests, nearly doubled in eight tests, and largely increased in four tests, by the addition of 100 pounds of 60 per cent of muriate of potash to the lime and phosphoric acid used.

Because of the rapid increase in the acreage being established in improved pasture and planted to legumes, and because of the pronounced results obtained by including potash in the fertilizer treatment, agricultural leaders predict that there will be a sharp increase in

A fine crop of cowpeas produced after harvesting a 50-bushel-per-acre oat crop. This is one way Mississippi farmers are doubling up to meet Food For Freedom goals.

the demand for potash fertilizers in the years ahead.

In 1943, Hinds county farmers alone made application to the County AAA Office for enough seeding mixtures and fertilizing materials to improve 10,000 acres of pasture. Holmes county seeded and fertilized 3,000 acres of pasture and planted more legumes. Claiborne county expanded an already extensive pasture program. Noxubee county went into pasture building on a big scale. A single farmer bought two car-

(*Turn to page* 42)

The yield of cotton in Mississippi has just about been doubled by growing and turning under green manure crops, planting good seed of the best varieties, and fertilizing with a complete, high analysis fertilizer. This field made 1½ bales per acre.

Maintaining Available Potassium in Soils

By R. E. Stephenson

Oregon State College, Corvallis, Oregon

THE average potash content of igneous rocks is 3.13 per cent; for sedimentary rocks 2.81 per cent, according to Clarke and Washington. The average of 76 typical Oregon soils is 1.66 per cent. The lower percentage of potash in soils compared with rock is illustrative of a fundamental process that goes on when rocks weather and soil is formed. Whatever is soluble slowly leaches and is lost. That which is most soluble leaches most rapidly. Thus igneous rocks contain somewhat more sodium than potassium, while the sedimentary rocks from which most of our soils are formed contain less sodium than potassium. The average of 36 typical American soils is twice as much potassium as sodium remaining in the soil. The ocean ultimately gets the sodium and many other elements which go into solution. There is 28 times as much sodium as potassium in ocean water.

Fortunately, sodium is not a nutrient element and its loss is of little consequence, or perhaps may sometimes be a favorable factor in crop production, since sodium accumulation may result in the formation of alkali soil. Calcium, which is an important nutrient element, is more readily lost from the soil than potassium, and because calcium serves to maintain neutrality in the soil, reaction may be associated with the potassium status. That is, there is relatively more potassium in soils that have remained nearly neutral than in those that have become acid. Hilgard reports 3⅓ times as much potassium (by acid digestion) in soils of arid areas as in soils of humid areas. A similar comparison for lime shows 12½ times as much lime in the unleached soils of arid areas; or there is about half as much lime as potassium in the soils of humid areas, but nearly twice as much lime as potassium in soils of the arid areas, according to Hilgard's data. This is from a comparison of 466 and 313 soils from humid and arid areas, respectively. Jenny remarks upon the fortunate economy of the greater loss of lime which is relatively much less expensive than potassium to replace.

Comparative Losses of Soil Fertility

The reserve supply of potassium in soils, therefore, is governed by what has happened in the ages past, largely through hydrolysis and leaching processes. Poor soils often are made poor by nature long before the advent of man. Of 11 separate geologic areas in Kentucky each including soils that are characteristic of the formation, the area with the lowest total averaged a little more than half as much potassium as the area with the highest total potassium content. The comparison was based upon an average of 27 representative soils from the poor area and nine soils from the good area, as presented by Averitt. This comparison represents at least qualitatively the changes that have been developing over a long period of time, and which perhaps are continuing slowly to progress still further toward soil depletion. The extent of depletion at any given time no doubt

depends upon the age of the soil and the vigorousness with which the depleting processes have been occurring.

The late Dr. J. G. Lipman presents data which indicate that cropped land loses more than twice as much potassium by leaching as by removal in harvested crops. The loss by erosion is more than eight times as great as the loss by crop removal. However, much of the potassium lost by erosion is in an inactive form and while the loss is real, the seriousness is not as great as the comparable figures would indicate. When erosion occurs, there is probably as much potassium in the raw and exposed subsoil as in the material that was removed. The total supply of potassium is not much changed by erosion, but there is probably a lower availability in the potassium of the raw subsoil. By contrast, all that is leached is soluble and represents the loss of the most readily available potassium.

Forms of Potassium

Soils normally contain at least three forms of potassium; that in the undecomposed primary minerals such as orthoclase feldspar, that in the secondary clay minerals and combined with the humus in exchangeable form, and that in a water-soluble condition such as the nitrates and sulfates of potassium. Often, in spite of the leaching, there is more of both the water soluble and the exchangeable potassium in the surface soil than in the deeper layers, though the total may not be very different in the various soil horizons.

Plants can readily use both water-soluble and exchangeable forms of potassium. Since there is a dynamic equilibrium between the different forms in the soil, the use of soluble potassium by the plant results in rapid equilibrium shifts to supply more in solution. The ultimate source of renewal of the soluble potassium is principally the exchangeable form which in turn is renewed by the reserve form in the primary minerals. A high total potassium content of the soil is therefore a favorable factor for long-sustained and high productivity of the soil. The soils most in need of potassium fertilization are the peats and sands of low reserve supplies, and the old leached or long-farmed and depleted soils. A study of a number of western Oregon soils indicates that the poorer leached soils may contain only one-fourth to one-third as much water-soluble and exchangeable potassium as the better soils. The total may show a similar variability. Some of these depleted soils have shown marked potassium-deficiency symptoms in the growth of certain plants.

Methods for evaluating the potassium needs of soils are not yet well worked out. Chemical methods applied directly to the soil may correctly indicate a relatively large or small supply, but standards for deciding upon fertilizer applications by the interpretation of such data are not too reliable. Chemical methods applied to the crop produced have considerable value, but these likewise have not yet been sufficiently standardized. Since the potassium content of the plant may to some degree reflect the available supply in the soil, this method of indicating the need for potassium fertilization would seem to have possibilities. The good work of Batjer and Magnus has led them to set up tentative standards of potassium needs for orchard trees by analyzing the leaves of the trees. Not less than one per cent of potassium in the leaves was found where trees were making vigorous growth, and 1.7 per cent of potassium in the leaves seemed about the minimum for maximum growth. Apple varieties were found to differ with respect to potassium needs, Delicious and Rome Beauty requiring perhaps 50 per cent more than York Imperial and Jonathan varieties, as probable minimum requirements.

No doubt there is a range of potassium content of the foliage which may be associated with adequate nutrition of most plants, but much work remains to be done to determine the needs of the many kinds and varieties of plants that are produced; and when the needs

(*Turn to page* 44)

Kudzu Conserves Southern Soils

By R. Y. Bailey

Chief, Regional Agronomy Division, Soil Conservation Service, Spartanburg, S. C.

RICH, green leguminous forage growing on thousands of once eroded, unsightly hillsides in the Southeast is being converted into meat and milk that will help to win the war against Japan and the other aggressor nations. Kudzu, which was introduced from Japan, is transforming once unproductive acres into valuable hay and pasture land.

In 1876, the Japanese exhibited a viny perennial legume at the Philadelphia Centennial Exposition. This plant was kudzu. Records of this introduction do not state whether crowns were brought from Japan or whether the plants at the Exposition were grown from seed. Small quantities of kudzu seed later were planted at various points in the South.

For a number of years after its introdustion kudzu was used principally as a shade plant around buildings, hence the common name of "Porch Vine." Its leafy vines make a pleasant shade and its attractive purple blossoms give off a fragrant odor on warm summer nights.

Although, as one farmer puts it, kudzu "hung around the house" for several years, it gradually gained recognition as a forage crop. Farmers noticed that all classes of livestock ate the green

A heavy blanket of kudzu developed from plants set in the spring of 1941 has stabilized this large gully that was rapidly spreading and destroying an adjoining area of rich loess soil near Natchez, Mississippi. Photographed in July 1943.

leaves and the tips of vines whenever they were allowed access to kudzu. Probably as a result of these observations, a few farmers began making field plantings of kudzu. Others planted it in and around gullies.

There is no accurate record of when the first kudzu crowns were offered for sale. A few were being sold as early as 1901. Lack of knowledge about the crop resulted in a high percentage of failures of earlier plantings. Frequently the quality of plants was very poor. Many of the earlier buyers received pieces of root on which there were no buds. Others received sections of vines on which there were no roots. None of the roots and few of the vine cuttings produced shoots after they were planted. In many instances, plants were kept after they were received until so dry that most of them were dead when planted.

Little was known about methods of planting. Plants were often set among weeds, broomsedge, or Bermuda grass without soil preparation. Often plants were laid on top of the ground and covered with a shoveful of soil. Cultivation was seldom given. As a result of all these unfavorable conditions, few plants lived through the first summer. Failure to get plants to live and grow discouraged most of those who planted kudzu during these earlier years.

Kudzu Is Not a Pest

Fear that kudzu might be a dangerous pest that would wrap up an entire farm also kept many farmers from planting this crop. There are, of course, a few farmers who still do not want any of "that vine" on their farms. As evidence that the pest idea is rapidly disappearing, many farmers who would not allow kudzu to be planted on their farms in 1935 and 1936, even though the Soil Conservation Service offered to furnish the plants and the labor to set them out, have since planted several acres at their own expense. One farmer in Pike County, Alabama, allowed a CCC camp to plant kudzu on terraces on a steep field. After the plants had grown a year he got worried about it and dug them up. Two years later after he had pastured his hogs on another field of kudzu, he dug crowns and planted the same terraces again.

Farmers who have mowed kudzu have been highly pleased with the yield and quality of the hay. Ed Tucker, Camp Hill, Alabama, has more than 50 acres of kudzu from which he harvests approximately 1½ tons of hay per acre each year. Most of the land that Mr. Tucker has in kudzu was severely eroded and much of it had been "turned out" before it was planted to kudzu. Mr. Tucker fertilizes his kudzu at about the same rate as he would soybeans for hay. He usually harvests one cutting per year.

Kudzu makes better hay if cut early in the summer than it does if mowing is delayed until late August or September. Unlike other kinds of hay, however, the quality does not deteriorate rapidly after it is ready to harvest. Hay of good quality may be harvested at any time in June or July, at farmers' convenience. By the middle of August plants usually begin to lose leaves and the mature foliage becomes tough and less palatable.

The long period over which kudzu hay may be harvested allows haying to be done during the slack season between cultivation and harvesting of other crops. This allows a better distribution of labor than prevails under the present system where cotton picking and the harvest of cowpea or soybean hay often conflict. As an example, in the fall of 1942 there was such a shortage of cotton pickers that town and city people were urged to assist farmers with their cotton picking. While cotton picking was at the peak on most farms in the Piedmont section, the harvest of cowpea and soybean hay also was at its peak. These farmers had no choice but to harvest cowpea and soybean hay then, or lose it.

On nearly all farms where this conflict between cotton picking and the

harvesting of cowpea and soybean hay occurs each year, there is enough idle, or steep, severely eroded land on which to grow kudzu to supply a substantial part of the hay needed on these farms. Furthermore, kudzu hay could be harvested during the slack season between cultivating and harvesting other crops.

In many cases, kudzu has been injured by mowing too often and at the wrong time of year. More than two cuttings per year usually have caused serious damage to stands. One cutting in June and a second just before frost have not usually injured stands, particularly where sufficient fertilizer was applied to keep the plants in good condition. Vigorous, well fertilized kudzu has suffered less damage from mowing than has unfertilized kudzu. Mowing in late August and September usually has damaged stands.

Kudzu As a Grazing Crop

Kudzu is a valuable grazing crop, if managed properly. Care must be exercised to prevent overgrazing. Farmers who keep stock off until kudzu makes enough growth for a cutting of hay and then regulate grazing so that the ground is kept well covered with green foliage are able to maintain good stands.

The carrying capacity of an acre of kudzu, like other types of pasture, depends largely upon the fertility of the land and the fertilizer treatment. On land of moderate fertility where sufficient fertilizer is applied to maintain a vigorous stand, an acre of kudzu will carry an animal unit from about the first of June until frost.

Kudzu is particularly valuable for grazing when other kinds of pasture fail because of drought. W. A. Stone, Pitts, Georgia, turned 20 head of beef cattle weighing about 500 pounds each on six acres of kudzu during a late summer drought in 1942. These cattle gained approximately 1,600 pounds during the 40 days they were on the kudzu.

Mr. Stone realized that he allowed the kudzu to be grazed too closely during this period, but was forced either to overgraze kudzu or feed his cattle. He expects to plant six additional acres as a part of his farm-conservation plan with the Middle Western Ocmulgee River Soil Conservation District. This will give him sufficient acreage to furnish pasture when he needs it, without overgrazing his kudzu.

Farmers in the Wiregrass Soil Conservation District in southeast Alabama are using kudzu as a summer pasture for hogs. Hogs grazed on kudzu require less than half as much feed and are in better condition when turned on peanuts for fattening than those that are kept on dry lot during the summer.

W. E. Bedsole, Slocomb, Alabama, grazed 69 shoats, 7 brood sows, and 4 cows on 7 acres of kudzu from May 1 to August 1, 1942. As evidence that he is well pleased with kudzu as a grazing crop Mr. Bedsole said, "I would not take $100 an acre for the kudzu."

The possibilities of kudzu as a soil-improving crop are becoming more evident as an increasing number of farmers plow established stands of it and follow with corn. Yields of corn following kudzu often are more than double the yields on similar soils without kudzu. Usually, the stand of kudzu is restored to a sufficient extent by the end of the summer to give protection to the land the following winter. This quick recovery following cultivation of corn makes kudzu particularly valuable as a soil-conserving crop in rotations on land that previously has been considered too steep for cultivation.

Claude Sikes, Camp Hill, Alabama, planted kudzu on a field of severely eroded idle land in 1935. He planted corn between the kudzu rows and cultivated it the first year. He harvested kudzu hay in 1939, 1940, and 1941, and plowed the land to get kudzu crowns in 1942. His kudzu crowns brought $30 per acre above digging cost. Corn that was planted after crowns were harvested produced 30 bushels per acre.

When asked what he thought about

Thorough disking following a broadcast application of fertilizer just before plants began to grow at the beginning of the third year worked the fertilizer into the soil, killed small weeds, and smoothed the surface for mowing on this South Carolina farm.

this kind of rotation Mr. Sikes said, "I believe kudzu is going to be the answer on poor, eroded land. The field where I grew 30 bushels of corn in 1942 was the poorest on my farm when kudzu was planted, otherwise, I would not have agreed to plant it to kudzu in 1935. Don't forget that the county average in Tallapoosa county is less than 20 bushels of corn per acre." The county average corn yield in 1942 was 12.6 bushels per acre.

Methods of establishing stands of kudzu have become better understood, and this is resulting in fewer failures due to poor stands. Farmers also are learning that if the surviving plants in poor stands are fertilized and cultivated, they will spread over the entire area to form a complete stand.

On the Southern Piedmont Experiment Station at Watkinsville, Georgia, several individual kudzu plants were set in plots 25 by 30 feet in the spring of 1941. These plants were fertilized liberally and were cultivated. By the fall of 1942 each plant had covered the plot on which it was planted and many of the runners had been turned back to keep all growth from each plant confined to the plot on which it was planted. At this rate of spread, 50 plants would cover an acre in two years.

The rapid growth of kudzu plants under favorable conditions has been the basis of reductions in the number of seedlings or crowns planted per acre. Row spacing has been increased to 25 feet and the distance between plants in the row reduced to 3½ feet. This relatively thick planting in the rows insures at least a fair stand, even if only 50 per cent of the plants survive. After a complete cover is developed along the rows the first growing season, the ground between the rows usually is completely covered by the end of the second season. With a spacing of 3½ feet in the row, 500 plants are required for an acre. This is only half as many as were being used a few years ago. This has reduced the cost of crowns approximately $4.50 per acre.

In some instances, good stands have been developed in 3 or 4 years by planting a row on each terrace on steep slopes. This method requires approximately 250 plants per acre, which is only one-fourth as many as formerly were planted.

A row of kudzu planted along each terrace line serves as a guide for contour tillage and provides considerable protection against erosion on steep unterraced slopes that are planted to peanuts or other war crops. After the stress of war production is over, kudzu may be allowed to spread over the entire area. This simple method requires a minimum of labor and plants.

Kudzu planted in well-prepared rows parallel to the banks of gullies through natural depressions has developed effective meadow strips. Gullies have been stabilized and silted up so that they could be crossed with mowers or other farm equipment. Where gullies were deep, filling was hastened by plowing the banks in after the ground was well covered with vines.

Needs Liberal Fertilization

Success in estabilshing stands of kudzu, especially with a small number of plants per acre, depends almost entirely upon the extent to which other requirements are met. Good land preparation, including deep breaking along the rows and harrowing to form a good seedbed, is essential to satisfactory survival and vigorous growth of plants.

Liberal fertilization in the rows is a second essential to rapid first-year growth. Approximately 200 pounds of superphosphate and 1 to 2 tons of manure per acre are usually applied in 25-foot rows. This gives seven times as much fertilizer per linear foot of row as would be used if the same rates per acre were applied in 3½-foot rows. Where manure was not available, 200 to 300 pounds of a complete fertilizer per acre have given good results. Particularly on soils where cotton rust indicated a deficiency of potash, 25 pounds of muriate of potash per acre have been beneficial.

Farmers who have been most successful in getting good stands and first-year growth applied the fertilizer in deep furrows and plowed to these furrows to form broad beds. Beds were prepared well in advance of planting to allow the soil to be firmed by rain, and were harrowed thoroughly just before planting so as to form a good seedbed and to destroy weeds.

Good plants are essential in getting a stand of kudzu. A kudzu plant must have at least one sound, unbroken fleshy root as much as six inches long and at least one sound bud. It is desirable to have as much as eight inches of fleshy root on each plant, but it is not always feasible to get them dug with more than six inches of root.

Seedling plants have been the most satisfactory kind of planting material used, but the supply of seed is not sufficient to produce all plants needed. Kudzu is not a consistent seed producer in the South. Sufficient seed is produced most years, however, to be worth collecting. A total of 864 pounds of clean seed was collected in soil conservation districts in the Southeast in 1942. Approximately 700 pounds of this seed were collected in Alabama, where there is a larger acreage of well-established stands than in most other southern states.

Crowns from fields where kudzu is growing constitute the most important source of planting stock. Kudzu crowns have been dug satisfactorily with a single disc plow set fairly straight and weighted to make it take the ground. If run as much as eight inches deep, the disc turned the crowns out with a minimum of damage. They also have been dug with moldboard plows. Careful grading to remove all crowns that are severely torn, bruised, or broken is essential in getting good stands of kudzu.

Care in Planting Essential

Crowns require careful handling from digging until they are planted. They must be kept moist. Crowns that are not planted soon after digging can be kept in good condition by heeling them out in moist soil. If they are to be kept for a month or more before planting, clean, moist sand is ideal material in which to heel them out. It

is extremely important that crowns or seedlings shipped from one point to another be opened up, and either planted or heeled out immediately after they are received.

Careful planting is absolutely essential. Plants may be set by hand, either in holes dug with a mattock or a shovel, or in furrows. Where heavy applications of fertilizer and manure have been bedded on in the rows, it is advisable to dig holes for plants a few inches away from the center of the bed. Stands have been severely damaged by planting in the center of the row so that the roots of the plants were brought into direct contact with stable manure. Holes should be dug deep enough to accommodate the roots without crumpling them. The soil should be packed firmly about each plant so that the bud is level with, or slightly below, the surface of the soil. Poor stands have resulted from planting on heavy soils when the ground was wet.

Furrow Method of Planting

Planting in deep furrows has given good results. After the soil along the row was prepared with a plow, a deep furrow was opened and plants were placed against the wall of the furrow with enough soil packed about the roots to hold them in place. A furrow was plowed to the plants so as to lap the soil well up around the buds of the plants, and then a second furrow was plowed in the same direction to fill the first furrow. For convenience in covering, plants were placed against the lower wall of the first row and then against the upper wall of the second row. This only required dragging the plow across from the end of one row to the next.

Where fertilizer is not applied in the rows before planting, it may be applied in the first covering furrow and covered with the second furrow slice. It is extremely important that planting furrows on deep sandy soil be laid out deep enough to insure having the roots in contact with moist soil during periods of drought. Good stands have resulted from plowing sandy soil away from the rows so as to set plants in the bottoms of water furrows.

Satisfactory stands have been obtained by plowing areas of kudzu, collecting crowns, roots, and vines behind the plow, strewing them thickly in furrows, and covering 2 to 4 inches deep. Lighter covering was given on heavier than on the lighter soils. This method of planting is practicable only where plenty of kudzu is available so that the labor of plowing up, collecting, and strewing crowns represents the only cost. It is not a dependable method of getting a stand where only 500 to 1,000 crowns per acre are planted.

The ideal time to plant kudzu is in early spring just before active growth begins. On soils that heave plants out during freezes, it is safer to delay planting until danger of freezes and heavy frosts is past. On soils where severe heaving does not occur, plants may be set in late winter and early spring. Where labor is scarce, it is advisable to plant early so as to avoid interference with other farm work. Careful planting done in late winter, even with a certain amount of cold injury, is preferable to hasty, careless planting done later in the season when kudzu planting conflicts with other farm work.

Green kudzu crowns were planted successfully during the months of May, June, and July in 1942 and 1943. Crowns that were formed where vines took root at nodes the previous year were lifted with a round-pointed shovel. The shovel was pressed down to full depth so as to get approximately eight inches of undamaged roots. Holes were dug deep enough to accommodate the roots, each hole was filled about half full of water, roots were pressed down into the mud and water in the bottom of the hole, and dry soil was pulled in and pressed firmly about the plant. Green tops were cut back to two or three inches in length.

(*Turn to page* 48)

Plump ears where "nubbins" formerly grew, near Camp Hill, Alabama. Corn following kudzu made 30 bushels per acre in 1942 as compared with a county average of 12.6 bushels per acre that year.

Kudzu on steep land adjacent to the permanent pasture is furnishing additional grazing on this Virginia farm.

Kudzu is completely controlling erosion and is furnishing summer pasture for hogs near Port Gibson, Mississippi.

A typical galled area near Greenville, Alabama, was planted to kudzu in the spring of 1937. See photo below.

By the summer of 1939 the unsightly area shown in the photo above was converted into a valuable hay meadow.

Vertical highway banks in the deep loess hills of southwest Mississippi are fully protected by kudzu.

Control of brush and weeds along drainage canal banks is another important job that kudzu is doing.

The Editors Talk

A New Job Sheet for Farmers

Every farmer wants to make the operation of his farm more efficient. On its efficiency depends the margin of his profit. There is no end to what he should know about the application of the findings of agricultural research, since new theories constantly are being shaped into facts for his use. Of note in this connection is what constitutes a departure from the former conception of what a farmer needs to know about his land—a yardstick of "land capabilities."

This yardstick stems from a new survey charting actual conservation needs for the United States based on strict adherence to land capabilities. The survey and its practical application is discussed by Wellington Brink, editor of Soil Conservation, in the October issue of that publication. "For the first time in history a practical 'job sheet' is available to American farmers," Mr. Brink says. "It outlines, area by area—and eventually will outline farm by farm—the soil conservation practices that must be put on the land to assure maximum farm production at minimum soil loss. It is the result of a year's survey by several hundred trained technicians of the Soil Conservation Service, a survey which Chief H. H. Bennett says is fast nearing completion."

Tabulations of figures have been rolling in through many months—from New England and the deep South, from the cut-over areas of Wisconsin and the plains of Texas, from the wheat fields of Washington and the citrus groves of California. A blueprint of a rural America that can be made fully productive and soil-secure by the science of soil conservation is being developed farm by farm, county by county, state by state.

Dr. Bennett admits that cutting the whole new pattern indicated by the Soil Conservation Service survey will entail a staggering outlay of money, technical personnel, labor, machinery, fertilizers, and seed. It will take years to do the entire job, he says—but even the beginnings already made have paid rich and immediate dividends. Major war crops have already responded with 20 per cent increased yields, where soil conservation measures have been applied.

It is pointed out that in 1942, for example, soil conservation practices put on 10 million acres accounted for an increase of nearly 34 million pounds of peanuts and more than 37 million pounds of beef or beef equivalent. Eleven other major war commodities paid comparable dividends from soil conservation: wheat, soybeans, corn, hay, cotton, flaxseed, dry beans, cottonseed, potatoes, grain sorghums, and field peas. Records of the Soil Conservation Service indicate that when the new farming methods are properly applied to an average acre of corn land, a 7-bushel increase in yield can be anticipated, an immediate dividend which follows right along the first year. It is believed highly doubtful that if every pasture now grazed by the dairy cow were to be properly assigned, planted to the right grasses and legumes, worked into a rotation chart, given what lime and

fertilizers its requires, the rationing of butter, cheese, and other dairy products would ever be necessary.

The Soil Conservation Service, through its land-capability maps, now provides a farmer with utilitarian classifications of his land according to a framework of physical factors. Uses of land—now indicated by a series of eight numbers, and as many colors—are determined by soil, slope, erosion, and climate. Uses are of four main categories—crops, grass, woods, and miscellaneous.

The new conservation-needs survey is a translation and a summary of what it will take to convert every bit of land to its safest, most profitable, and most efficient form of production. In assigning roles, the survey places continuing productiveness second only to immediate productiveness for war purposes.

High Analysis Fertilizers

Quoted below is the statement made by the U. S. Department of Agriculture on October 19, 1943, relative to the economy in high analysis fertilizers and the urgency of their purchase by farmers as soon as possible.

"The War Food Administration calls to the attention of farmers an important fact regarding their purchases of mixed fertilizer—that they can save money and at the same time contribute substantially to the war effort by buying higher analysis fertilizers.

"WFA officials in charge of the fertilizer distribution program point out that higher analysis fertilizers will cost more per 100 pounds than those of lower plant-food content, but that the cost per pound of plant food is lower.

"Using a comparison between a 5-10-5 mixed fertilizer and a 4-8-4 fertilizer as an example, WFA officials said that 4 bags of 5-10-5 will furnish 80 pounds of plant food (nitrogen, phosphoric acid, and potash), whereas it would take 5 bags of 4-8-4 to supply the same number of pounds.

"Fertilizer prices vary somewhat by states and areas, but in North Carolina—the Nation's largest user of commercial fertilizer—a ton of 5-10-5 in 100-pound bags costs approximately $34.90, compared to about $30.40 for a ton of 4-8-4. On the basis of plant-food content, it would require 2,500 pounds of 4-8-4 to provide the same number of pounds of plant food contained in one ton of 5-10-5. Twenty-five hundred pounds of 4-8-4 costs about $38; comparing this cost to that of a ton of 5-10-5 at $34.90, the farmer has a saving of $3.10 by purchasing the high analysis grade.

"Aside from the saving in cost, the farmer who uses higher analysis fertilizer will be helping to relieve transportation, packaging, and storing problems in connection with the manufacture and shipment of mixed fertilizer. The use of higher analysis fertilizer means that fewer bags will have to be used, and consequently fewer packages will have to be shipped over the Nation's already overtaxed transportation system. The situation on materials for supplying bags requires that all measures be taken in the conservation of their use. Furthermore, fertilizer mixers' storage facilities are crowded, and use of higher analysis goods will ease this situation.

"WFA officials also stressed that in order to help make the fertilizer distribution program fully effective, farmers should make application for mixed fertilizer as soon as possible and take delivery on it during the fall and winter months. This applies to fertilizer needed both this fall and next spring. Farmers apply to their local dealers for fertilizer."

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	...
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	..
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
October	18.87	42.3	102.5	107.9	77.5	103.5	9.39	46.46	....
November	19.22	39.8	108.4	103.5	75.9	104.4	9.84	45.01	....
December	19.55	40.0	111.8	110.3	80.2	110.3	10.46	44.72	....
1943									
January	19.74	35.1	117.8	121.4	88.0	117.5	11.20	44.34	....
February	19.68	18.2	125.7	129.8	90.4	119.5	11.94	44.88	...
March	19.91	16.0	145.1	153.6	94.8	122.7	12.28	45.73	....
April	20.13	16.0	166.8	179.2	100.2	122.3	12.61	45.89	....
May	20.09	37.6	190.7	225.1	103.4	122.8	12.66	46.11	....
June	19.96	57.0	188.0	222.0	106.0	124.0	12.20	46.40	....
July	19.60	59.0	167.0	267.0	108.0	126.0	11.90	44.50	....
August	19.81	38.4	159.0	276.0	109.0	127.0	12.20	50.90	....
September	20.20	37.2	134.0	231.0	109.0	130.0	12.90	51.90	....
October	20.28	41.8	128.0	196.0	107.0	135.0	13.70	52.50	....

Index Numbers (1910-14 = 100)

1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
October	152	407	147	123	120	118	79	215	226
November	155	383	156	118	117	119	82	208	238
December	158	385	161	126	124	125	88	207	293
1943									
January	159	338	169	139	136	134	94	205	277
February	159	175	181	148	140	136	100	208	301
March	161	154	208	175	146	139	103	212	302
April	162	154	240	205	155	139	106	213	291
May	162	362	274	257	160	140	106	214	253
June	161	548	270	253	164	141	102	215	308
July	158	567	240	305	167	143	100	206	315
August	160	369	228	315	168	144	102	236	308
September	163	358	193	264	168	148	108	240	311
October	164	402	184	224	165	153	115	243	264

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11-12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated, 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16-17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.30
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
October	1.75	1.42	5.72	5.77	3.34	4.86	6.80
November	1.75	1.42	6.06	5.77	3.34	4.86	6.53
December	1.75	1.42	5.68	5.77	3.34	4.86	6.53
1943							
January	1.75	1.42	5.68	5.77	3.34	4.86	6.53
February	1.75	1.42	5.83	5.77	3.34	4.86	6.53
March	1.75	1.42	6.30	5.77	3.34	4.86	6.53
April	1.75	1.42	6.29	5.77	3.34	4.86	6.53
May	1.75	1.42	6.29	5.77	3.34	4.86	6.53
June	1.75	1.42	6.30	5.77	3.34	4.86	6.53
July	1.75	1.42	6.30	5.77	3.34	4.86	6.71
August	1.75	1.42	6.30	5.77	3.34	4.86	6.71
September	1.75	1.42	6.30	5.77	3.34	4.86	6.71
October	1.75	1.42	6.29	5.77	3.34	4.86	6.71

Index Numbers (1910-14 = 100)

1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	112	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
October	65	50	163	163	110	144	193
November	65	50	173	163	110	144	186
December	65	50	162	163	110	144	186
1943							
January	65	50	162	163	110	144	186
February	65	50	167	163	110	144	186
March	65	50	180	163	110	144	186
April	65	50	180	163	110	144	186
May	65	50	180	163	110	144	186
June	65	50	180	163	110	144	186
July	65	50	180	163	110	144	191
August	65	50	180	163	110	144	191
September	65	50	180	163	110	144	191
October	65	50	180	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.607
1940	.516	1.90	5.50	.517	.730	....	.573	....
1941	.547	1.94	5.64	.522	.779	25.55	.570	....
1942	.600	2.13	6.29	.522	.809	25.74	.205	....
October	.600	2.10	6.20	.535	.817	26.00	.210	....
November	.600	2.00	5.90	.535	.817	26.00	.210	....
December	.600	2.00	5.90	.535	.817	26.00	.210	....
1943								
January	.600	2.00	5.90	.535	.817	26.00	.210	....
February	.600	2.00	5.90	.535	.817	26.00	.210	....
March	.608	2.00	5.90	.535	.817	26.00	.210	....
April	.640	2.00	5.90	.535	.817	26.00	.210	....
May	.640	2.00	5.90	.535	.817	26.00	.210	....
June	.640	2.00	5.90	.471	.701	22.88	.176	....
July	.640	2.00	5.90	.503	.797	26.00	.188	....
August	.640	2.00	5.90	.503	.797	26.00	.188	....
September	.640	2.00	5.90	.503	.797	26.00	.188	....
October	.640	2.00	5.90	.535	.797	26.00	.200	....

Index Numbers (1910-14 = 100)

1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	116	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	....	87	....
1941	102	54	116	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
October	112	58	127	75	86	108	85	....
November	112	55	121	75	86	108	85	....
December	112	55	121	75	86	108	85	....
1943								
January	112	55	121	75	86	108	85	....
February	112	55	121	75	86	108	85	....
March	113	55	121	75	86	108	85	....
April	119	55	121	75	86	108	85	....
May	119	55	121	75	86	108	85	....
June	119	55	121	66	74	95	80	....
July	119	55	121	70	84	108	82	....
August	119	55	121	70	84	108	82	....
September	119	55	121	70	84	108	82	....
October	119	55	121	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	142	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	157	151	112	100	131	109	80
1926.....	145	155	146	119	94	135	112	86
1927.....	139	153	139	116	89	150	100	94
1928.....	149	155	141	121	87	177	108	97
1929.....	146	153	139	114	79	146	114	97
1930.....	126	145	126	105	72	131	101	99
1931.....	87	124	107	83	62	83	90	99
1932.....	65	107	95	71	46	48	85	99
1933.....	70	109	96	70	45	71	81	95
1934.....	90	123	109	72	47	90	91	72
1935.....	108	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	121	130	126	81	50	129	95	75
1938.....	95	122	115	78	52	101	92	77
1939.....	93	121	112	79	51	119	89	77
1940.....	98	122	115	80	52	114	96	77
1941.....	122	130	127	86	56	130	102	77
1942.....	157	152	144	93	57	161	112	77
October...	169	155	145	92	57	154	112	79
November.	169	156	146	93	57	158	112	79
December..	178	158	147	92	57	154	112	79
1943								
January...	182	160	149	92	57	154	112	79
February..	178	162	149	92	57	155	112	79
March....	182	163	150	93	57	160	113	79
April.....	185	165	151	95	57	160	119	79
May.....	187	167	152	95	57	160	119	79
June.....	190	168	151	93	57	160	119	69
July.....	188	169	150	94	57	160	119	74
August....	193	169	150	94	57	160	119	74
September.	193	169	150	94	57	160	119	74
October...	192	170	150	95	57	160	119	78

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

The quantity and quality of potatoes produced in Aroostook County, Maine, have made Maine potatoes famous all over North America, and the fertilizer and other cultural practices followed by growers in this highly successful region are helpful and valuable guides to growers in other sections. The Maine Experiment Station has conducted a series of tests among growers in the County under practical conditions and also has carried on experiments over a period of years on an experimental farm under its own control. This work is now summarized in Bulletin 414 of the Maine Agricultural Experiment Station entitled, "Potato Fertilizer-Rotation Studies on Aroostook Farm 1927-1941", prepared by J. A. Chucka, A. Hawkins, and B. E. Brown. As the title indicates, most of the data and discussion relate to the experimental farm results, although references to other work carried on in the State are given.

Before interpreting responses of fertilizers, the authors determined the influence of rainfall and temperature conditions on potato yield. They found that increasing rainfall during the growing season tended to increase general yield levels, while there appeared to be an inverse relationship between temperature and yield. It is rather obvious why plenty of rainfall produced high yields, but the fact that high temperatures tended to reduce yields is thought to be due to increase in insect and disease attacks during higher temperatures and the greater drain on water supply due to transpiration and evaporation.

In order to answer the question, "How frequently potatoes can be grown on the same land?" rotation experiments were conducted, with uniform standard fertilization over the entire area. Highest yields were obtained in a two-year rotation consisting of potatoes one year and a leguminous green manure crop the second year. The next best rotation was potatoes one year, oats one year and clover one year. The lowest yields were obtained where potatoes were grown continuously, a difference of 53 bushels per acre being obtained between the highest and lowest yields, this 53 bushels representing the value of taking one year out to grow a green-manure crop. The authors point out that this rotation experiment was conducted under favorable conditions where soil erosion was held to a minimum. On soils more subject to erosion, undoubtedly the continuous growing of potatoes would not give as good results as obtained in this experiment.

Another series of tests obtained results on turning under different quantities of organic matter, either as green manure or as straw, and these results were compared with potatoes grown without any organic matter added, and with manure applied. Turning under organic matter in any of the three forms used was beneficial, although in varying degrees. When straw was used, it increased yield to the extent of making the straw worth $2.75 per ton. The manure was worth about $3.00 a ton when used on potatoes grown con-

tinuously and worth about $1.35 a ton when used on potatoes grown in rotation. In all cases, the potatoes were considered as worth $.60 a bushel. When the straw was first used in experiments, potato tops were light green in color indicating nitrogen deficiency, but in later years this effect disappeared. During the early years of the work, manure produced clean potatoes, but in later years, they tended to become scabby. The authors recommend that the use of manure on potatoes be limited to about 10 tons per acre, so as to use manure efficiently and reduce danger of scab injury.

A 4-8-7 fertilizer was used at amounts varying from 500 to 3,000 pounds per acre. Yield increased regularly with increased rate of fertilizer application, with the largest increment coming from the smallest applications, although highest total yields coming from the highest applications, in all cases, the returns being profitable and paying for the fertilizer. As to whether it would always be profitable to use such large amounts of fertilizer, the authors caution that the general fertility level of the farm and the amount and distribution of the rainfall are factors which should be taken into consideration in this connection.

Another series of experiments compared different fertilizer analyses, in all cases, with one nutrient variable and the other two held constant. Thus nitrogen was varied from 0 to 6% by 2% increment, with the phosphorus held at 8% and the potash at 7%. In another series, the phosphorus was varied from 0 to 12% by 4% increment, with nitrogen held at 4% and potash at 7%. In a third series, the potash was varied, with 0, 4, 7, 10 and 14% being applied in the fertilizer, with the nitrogen being held constant at 4% and the phosphoric acid at 8%. The rate of application in all cases was 2,000 pounds per acre. The largest increase of nitrogen was in the first 2% increment with smaller increases being obtained with the 4 and 6% applications. The potatoes unfertilized with nitrogen were light green in color throughout the entire growing season, indicating nitrogen deficiency, while those with the highest nitrogen application were much darker than normal. Under the conditions of this experiment, 4% phosphoric acid produced as high yields as 8 or 12%, but gave a substantial increase in yield over the potatoes not receiving any phosphoric acid. In the latter case, the plants were very small, but showed no other outstanding characteristics. The smallness was particularly noticeable during the early part of the season. The increasing of potash increased yield regularly through all the increments used in the experiments. When potash was completely omitted from the fertilizer, the yield of No. 1 potatoes was actually less than the completely unfertilized potatoes, although total yields were slightly above the entirely unfertilized. When potash was omitted, the plants were much smaller than normal and had a very dark green color. Later in the season, characteristic bronzing and chlorosis developed and the plants died very early. The use of 4% potash in the fertilizer eliminated the more severe signs of potash deficiencies on the plants, although they still were somewhat darker than normal in color. The plants with the highest potash applications were somewhat lighter in color than those on the check plots which received a 4-8-7 fertilizer. The authors conclude that more nitrogen and particularly more potash could be used with benefit than as applied in the 4-8-7 fertilizer.

In a series of experiments comparing sources of nitrogen fertilizer, best results for single carriers usually were produced by fish meal, urea, Leunasaltpeter, nitrate of soda, sulphate of ammonia, calcium nitrate, more or less in the order mentioned, with ammonium chloride and cyanamid usually giving lower yields. Particularly noticeable was the fact that a combination of nitrogen fertilizers usually gave bet-

ter results than any single source of nitrogen fertilizer. The results produced by the various carriers also were influenced considerably by the acidity of the soil on which they were used, with the physiologically acid nitrogen carriers being more favorable on the alkaline soils than the physiologically alkaline on acid soils. Applying part of the nitrogen as side-dresser, compared with all of the nitrogen at planting time, gave variable results from year to year, with the average not indicating much advantage to the split application.

In a study of the different potash carriers, muriate of potash was compared with sulphate of potash in a 4-8-8 applied at the rate of one ton per acre. Yields were about the same in both cases, although other work at outlying fields indicated that when higher rates of potash are used, sulphate of potash may give a higher yield than muriate. Chemical analyses of potatoes produced with these two sources of potash indicate that tubers grown with sulphate of potash will consistently have a higher percentage of starch and dry matter and develop less stem-end browning in storage.

Comparison of results produced by double-strength fertilizers with those from ordinary strength fertilizers, with the same ratios of plant-food in both cases, indicated little difference in yields. It is difficult to make direct comparison in these cases, since the lower-analysis fertilizers contain an impurity of certain nutrients which may not be present in the higher analysis fertilizers, magnesium being particularly important in this respect. If magnesium is properly provided in high-analysis fertilizers, the data indicate that they are equal to the ordinary standard strength analyses. Comparing results produced by standard-strength fertilizers, in one case made from pure chemicals and the other using standard sources of nutrients showed a slight advantage for the standard sources that begins with the chemically pure sources. In work that had only run four years, there was found to be little benefit from correcting the physiological acidity of the fertilizer and a slight benefit from adding magnesia.

The residual effects of the fertilizer applied on potatoes on the other crops in the rotation were observed. In the rate of application tests, there appeared to be a carry-over effect, with the higher rates of applications on potatoes also giving higher yields on the oats. There was little influence of residual effect of different ratio fertilizers on the yield of oats. In the case of clover also, a higher rate of application on potatoes tended to give higher yield of clover. Where phosphorus or potash were omitted and where nitrogen was applied in the largest amounts, clover yields tended to be lower, but in all other cases, there was little difference in yield among the various fertilizer ratios applied.

The data and findings of this Bulletin are of great interest and value to all potato growers and the Bulletin is an important contribution to our agricultural effort.

"Acidulated Fertilizers for Arizona Soils," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., T. Bul. 101, June 25, 1943, W. T. McGeorge.

"Commercial Fertilizers Registrants to Date for Fiscal Year Ending June 30, 1944," Dept. of Agr., Sacramento, Calif., FM-69, Sept. 27, 1943.

"Agricultural Minerals Registrants to Date for Fiscal Year Ending June 39, 1944," Dept. of Agr., Sacramento, Calif., FM-70, Sept. 27, 1943.

"State Laboratory Fertilizer and Seed Report, January-June 1943," State Board of Agr., Dover, Del.

"A Preliminary Report on Iron Deficiency of Tung in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 381, Dec. 1942, R. D. Dickey.

"Artificial Manures," Dept. of Agron., Univ. of Ill., Urbana, Ill., AG 1169, Aug. 1943, M. D. Appleman.

"1943 Maine Fertilizer Sales by Grades," Agr. Exp. Sta., Univ. of Me., Holmes Hall, Orono, Me.

"Fertilizer Recommendations for North Carolina 1943-44," Agr. Exp. Sta. State College Station, Raleigh, N. C., Agron. Inf. Cir. 133, Aug. 1943.

"Summary of fertilizers, fertilizer Materials and Consumers' Mixtures Sold in South Carolina as Reported by Manufacturers for the Fiscal Year July 1, 1942 Through June 30, 1943."

"Plant Tissue Tests Versus Soil Tests for Determining the Availability of Nutrients for Tobacco," Va. Agr. Exp. Sta., Va. Poly. Inst., Blacksburg, Va., T. Bul. 84, March 1943, G. M. Shear.

"Production and Fertilizer Use of Urea," U.S.D.A., Washington, D. C., Cir. 679, Albert R. Merz and Bailey E. Brown.

Soils

It is frequently believed that soil erosion is not a serious factor in the northern part of the country, mainly due to the fact that the soils are frozen during the winter and are usually covered with crops or other vegetation during the summer. While it is true that the effects of erosion usually are not so spectacular in the North as they are in the South, the fact remains that it is still a serious problem. It is possibly all the more dangerous because the effects are not so noticeable and the public may be lulled into a false sense of security. The fallacy of the belief in lack of soil erosion in the North is very strikingly brought out in U. S. Department of Agriculture Soil Conservation Service Miscellaneous Publication 516, entitled, "Erosion Lowers Wartime Production on Northeastern Farms." This Bulletin is made up of a series of photographs, each telling an important story, together with brief comments to bring out certain desired features. The easily observed gullies which occasionally occur in the North are shown, but probably of greater importance are pictures of the more gradual and insidious effects of erosion due to surface removal of the soil over a period of years. Stones left on pedestals of soil, appearance of bed-rock near the surface of the soil, the gradual "working up" of tile drains, which really means the gradual working down of the surface soil by erosion, exposures of tree roots formerly well covered by soil, differences in height of fields which were at one time level, surface rills, and other features show that erosion is going on in the North where proper steps are not taken to prevent it. The importance of preventing erosion so as to enable farms to produce their maximum in the war effort, and suggestions on how to take steps to prevent and control erosion are briefly presented in this Bulletin prepared by W. W. Reitz.

"Studies in Soil Structure—V. Bound Water in Normal and Puddled Soils," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., T. Bul. 100, June 20, 1943, T. F. Buehrer and M. S. Rose.

"Soil Survey — Blackfoot-Aberdeen Area, Idaho," U.S.D.A., Washington, D. C., Series 1937, No. 6, May 1943, E. N. Poulson L. B. Nelson, and A. E. Poulson.

"Soil Survey—Henderson County, North Carolina," U.S.D.A., Washington, D. C., Series 1937, No. 9, July 1943, S. O. Perkins, A. J. Vessel, William Gettys, C. W. Croom, S. F. Davidson, and E. F. Goldston.

"Soil Survey—Lucas County, Ohio," U.S. D.A., Washington, D. C., Series 1934, No. 24, May 1943, G. W. Conrey, R. A. Winston, F. Z. Hutton, and W. S. Eckmann.

"The Effect of Slope on Soil Erosion," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Res. Bul. 363, April 1943, H. H. Krusekopf.

"Soils and Soil Fertility for Alfalfa," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 493, June 1943, O. T. Coleman and A. W. Klemme.

"Soil Survey, Pickens County South Carolina," U.S.D.A., Washington, D. C., Series 1937, No. 7, July 1943, A. E. Shearin, C. S. Simmons, F. R. Lesh, and C. H. Wonser.

"Soil Survey, Dimmit County, Texas," U.S.D.A., Washington, D. C., Series 1938, No. 4, April 1943, Howard M. Smith and J. W. Huckabee, Jr.

Crops

"Nutritive Studies of Forage Plants," Agr. Exp. Sta., Fayetteville, Ark., Bul. 434, June 1943, M. C. Kik.

"Twenty-Third Annual Report," Dept. of Agr. Bul., Sacramento, Calif.

"Report of Minister of Agriculture," Province of Ontario, Toronto, Canada, March 31, 1942.

"Strawberry Production in Colorado," Agr. Exp. Sta., Colo. State College, Fort Collins, Col., Bul. 481, Sept. 1943, L. R. Bryant and George Beach.

"Growing Pecans in Georgia," Ga. Agr. Ext. Serv., Univ. System of Ga., Athens, Ga., Bul. 501, April 1943, Theodore L. Bissell and Elmo Ragsdale.

"Climate of the Palouse Area of Idaho as Indicated by Fifty Years of Climatological Data on the University Farm," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 245, Dec. 1942, K. H. W. Klages.

"Crops and Cultural Practices on Former Apple Orchard Land," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. 250, March

1943, Leif Verner and George W. Woodbury.

"Pasture and Feed the Foundation for Profitable Livestock," Agr. Ext. Serv., Baton Rouge, La., E. Cir. 248, Aug. 1943.

"Eighty-first Annual Report of the Secretary of the State Board of Agriculture of the State of Michigan and Fifty-fifth Annual Report of the Experiment Station from July 1, 1941 to June 30, 1942," Lansing, Mich., 1942.

"Studies in the Nature of the Clonal Variety, III. Permanence of Strain and Other Differences in the Montmorency Cherry," Agr. Exp. Sta., Mich. State College, East Lansing, Mich. T. Bul. 186, June 1943, V. R. Gardner.

"Studies in the Nature of the Clonal Variety, IV. Cytological Studies of Bud Sports of McIntosh, Stark and Baldwin Apples," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., T. Bul. 187, June 1943, Earl H. Newcomer.

"Propagation of Fruit Trees," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Sp. Bul. 142 (Fourth Printing), Rev. June 1943, H. A. Cardinell and F. N. Hewetson.

"Essentials of Blueberry Culture," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., C. Bul. 188, June 1943, Stanley Johnston.

"Farm Science Goes to War," N. J. Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., 63rd Annual Report, 1942.

"Experiments in the Production of Carrot Seed," Agr. Exp. Sta., N. M. College of Agr., State College, N. M., Bul. 308, June 1943, J. V. Enzie.

"A Descriptive and Historical Study of Some Yellow Sweet Corn Hybrids," N. Y. Agr. Exp. Sta., Geneva, N. Y., Bul. 705, May 1943, W. D. Enzie.

"Alfalfa, Its Place in a Balanced Feed Program," Agr. Ext. Serv., State College Station, Raleigh, N. C., War Series Bul. 21, Aug. 1943.

"Report of the Puerto Rico Experiment Station 1942," U.S.D.A., Washington, D. C., June 1943.

"The 1942 South Dakota Hybrid Corn Yield Test," Agron. Dept., S. Dakota State College, Brookings, S. Dak., Cir. 45, April 1943, E. R. Hehn and J. E. Grafius.

"Studies in Tolerance of New England Forest Trees," Agr. Exp. Sta., Burlington, Vt., Bul. 499, Sept. 1942, G. P. Burns and E. S. Irwin.

"Meeting the Protein Requirements of Dairy Cows," Vt. Agr. Exp. Sta., Burlington, Vt., Pamphlet No. 1, March 1943, H. B. Ellenberger.

"Growing Potatoes in West Virginia," W. Va. Agr. Exp. Sta., Morgantown, W. Va., Cir. 78, July 1943, K. C. Westover and J. G. Leach.

"Good Corn Silage," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 337, June 1943.

"Sow Winter Grain for Food and Feed in Northern Wisconsin," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 338, June 1943, E. J. Delwiche.

"High-grade Alfalfa Hay," U.S.D.A., Washington, D. C., Farmers Bul. 1539, June 1943. W. H. Hosteman.

"Nursery Fruit Trees, Dwarf and Standard Understocks, Their Handling and Planting," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Pop. Bul. 170, March 1943, E. L. Overholser, F. L. Overley, J. H. Schultz, and D. F. Allmendinger.

"Diseases of Pears in Washington," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Pop. Bul. 171, April 1943, J. G. Harrar and J. D. Menzies.

"What's New in Farm Science," Agr. Exp. Sta., Univ. of Wis., Madison, Wis., Bul. 460, April 1943.

"Fifty-Second Annual Report 1941-1942," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo.

"Soybean Diseases and Their Control," U. S. D. A., Washington, D. C., F. B. 1937, May 1943, Howard W. Johnson and Benjamin Koehler.

"Good Pastures," U. S. D. A., Washington, D. C., F. B. 1942, May 1943, A. T. Semple and M. A. Hein.

"Legume Seed Production in the North," U. S. D. A., Washington, D. C., AWI-49, July 1943.

"Pastures of Puerto Rico and their Relation to Soil Conservation," U. S. D. A., Washington, D. C., M. P. 513, May 1943, H. W. Alberts and Ovidio Garcia-Molinari.

"Sugar-Beet Seed Production in Southern Utah, with Special Reference to Factors Affecting Yield and Reproductive Development," U. S. D. A., Washington, D. C., T. Bul. 845, June 1943, Bion Tolman.

Economics

¶ With American agriculture being called upon to produce the maximum possible quantity of food, seed and fibre with limited supplies of manpower, machinery, and fertilizers, careful thought and planning must be given to the utilization of the resources available. An excellent example of how the situation may be appraised is furnished by a mimeographed booklet issued jointly by the Ohio Agricultural Experiment Station and Ohio State University. It is entitled, "Maximum Wartime Agricultural Production in Ohio," and was prepared by a committee of state and federal agricultural agencies operating in the state. This Committee briefly presents a survey of the present agricultural production by crops, products, and agricultural sections of the State. Possibilities for expanding production of desired crops, contracting acreages of crops not so greatly in demand, and at the same time

maintaining soil productivity levels, or at least reducing to a minimum depletion of fertility under the stress of wartime conditions are outlined. Factors operating to increase or decrease production of important crops are itemized and production over recent years together with probable and maximum possible production by 1945 by crops and livestock products is given.

¶ The utilization of lime and fertilizer to achieve desired production together with the estimated amounts of various grades of fertilizer that would be needed for maximum production is tabulated, the latter figures are broken down by crops and represent a large increase over present fertilizer consumption. One of the basic assumptions of the entire study was that increased crop production in Ohio can most efficiently and effectively be obtained by increasing yield per acre rather than by trying to increase total acreage, which necessarily would involve attempts to grow crops on soils not adapted to them, with consequent inefficient use of seed, manpower, equipment, materials, and in many cases, serious deterioration of soil. This survey would appear to be a distinct contribution to the war effort of Ohio agriculture.

"Farm and Family Incomes and Expenses of Low-Income Farm Families in Indiana," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 485, July 1943, F. V. Smith.

"Land Classification in Waldo County, Maine," Agr. Exp. Sta., Univ. of Me., Orono, Me., Bul. 417, April 1943, Andrew E. Watson.

"Farm Credit in Aroostook County, Maine," Agr. Exp. Sta., Univ. of Me., Orono, Me., Bul. 418, April 1943, Charles H. Merchant.

"Agricultural Finance in Massachusetts," Agr. Exp. Sta., Mass. State College, Amherst, Mass., Bul. 405, June 1943, Sargent Russell and A. H. Lindsey.

"Post-War Agriculture," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 276, Aug. 1943, Frederick B. Mumford.

"The Post-War Agricultural Experiment Station," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 278, Sept. 1943, Frederick B. Mumford.

"Maximum Wartime Agricultural Production in Ohio," Agr. Exp. Sta., Ohio State Univ., Columbus, Ohio, July 1943.

"Migration and Status of Open-country Families in Oklahoma," Agr. Exp. Sta., Okla. A. & M., Stillwater, Okla., T. Bul. No. T-19, Sept. 1943, Robert T. McMillan.

"Recent Population Trends in Oklahoma," Agr. Exp. Sta., Okla. A. & M. College, Stillwater, Okla., Bul. B-269, Aug. 1943, Otis Durant Duncan.

"An Economic Classification of Land, Blair County, Pennsylvania," Agr. Exp. Sta., State College, Pa., Bul. 439, Jan. 1943, W. E. Keeper.

"Land, People, and Farming in a Rurban Zone," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Bul. 285, Nov. 1942, William R. Gordon and Gilbert S. Meldrum.

"Burley Tobacco Enterprise on Upland Farms Near Douglas Reservoir," Agr. Exp. Sta., Univ. of Tenn., Knoxville, Tenn., R. Res. Series Mon. 147, March 15, 1943, Leo J. Fenske and C. E. Allred.

"Economic Conditions and Problems of Agriculture in the Yakima Valley, Washington, Part VI. The Irrigation Project of the Yakima Indian Reservation," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Bul. 430, June 1943, Alden E. Orr.

"American Farmers and the United Nations Conference on Food and Agriculture," U.S. D.A., Washington, D. C., The Farmer and the War—No. 5, Aug. 1943.

Mississippi Farmers Improve Their Soils

(*From page* 18)

loads of pasture seed. Pike, Lincoln, Scott, Rankin, Copiah, Montgomery, Lauderdale, Smith, Simpson, Marion, Madison and other counties have carried on extensive pasture improvement programs, and throughout the entire State farmers continue to increase the acreage planted to winter legumes.

With the unlimited wartime demand for food and with the use of fertilizers one of the surest means of obtaining large and immediate increases in crop and pasture production, farm leaders have asked Government officials and fertilizer manufacturers to take "strong measures" to make more fertilizer available to farmers in 1944.

Shorthorn cattle on J. H. Gearheart's farm in Hinds County, Mississippi, improved by seeding, liming, and fertilizing. A cash crop of white clover seed was harvested the first week in June.

Put It On—Not Off

(*From page* 8)

right well by me," he added as his eyes trailed off across the fence into the melon patch.

He credited the high yield to the care of the land and use of lime and fertilizer. "For 30 years I've been using fertilizer," he said, "and the longer I go, the heavier I use it.

"I take pride in the fact that up to this year I never sold a thing off the place, outside of wheat or sweet clover seed, that couldn't walk off. This year, though, I'm growing those tomatoes and beans over there for the cannery to help feed some of the boys at the front."

Harreld began to appreciate the virtues and possibilities of fertilizers in 1912, when he cooperated with the Purdue Agricultural Experiment Station on some fertilized wheat plots. Lime, too, is nothing new on his land. At the suggestion of a man from Purdue, he began burning limestone with natural gas on his own farm in 1914. In applying fertilizer, he follows the recommendations of County Agent F. E. Conder and the Grant County Soil Conservation District of which Harreld is a supervisor.

On the 9-acre field, much of which slopes as much as five per cent, Harreld hauled 60 tons of manure in the 1938-39 winter. That fall he harvested a 90-bushel-per-acre crop of corn.

Without a nurse crop, he seeded a mixture of 12 pounds of alfalfa and four pounds of timothy on May 10, 1940. At seeding time, he applied 250 pounds of 0-20-20 per acre, and followed this up with 300 pounds of 0-20-0 in 1941. He made the second application with a disk drill following the first cutting.

Last year, after the first cutting, he put on an additional 220 pounds per

acre of 0-8-24. The first cutting, which averaged four tons per acre, was approximately half alfalfa and half timothy. The second cutting of two tons per acre averaged about two-thirds alfalfa and one-third timothy.

The 1942-43 winter was particularly severe on alfalfa in Harreld's neighborhood. Many stands winter-killed, but his came through in remarkably good shape, and in spite of some thinning, his first cutting ran 3½ tons per acre. He attributes the survival to the fertilizer, and wishes "I could get all I want nowadays."

Harreld has his own slogan to guide him in his use of fertilizers. "Put it on," he says, "don't put it off."

Maintaining Available Potassium in Soils

(*From page* 20)

of the plant are known, much more work will be necessary to establish field rates of fertilization necessary to provide an adequate amount of potassium to the plant. Qualifying the use of all such information when it is obtained is the economic problem of how much fertilization may prove profitable.

The question of the function of potassium in plant nutrition can be answered in the acknowledgment, "We don't know," though there are the familiar surmises as to its functions based upon reasonable evidence. Potassium probably is not built into any organic compound to give it physiological significance. Potassium is present as soluble salts in the plant sap, and in combination with organic acids sometimes in insoluble form. Potassium is abundant in the buds, young leaves, and root tips where growth is most active but is relatively sparse in wood and old tissue. No other element can replace potassium in the functions that it serves, which are apparently largely of catalytic nature. Potassium is none the less important in plant nutrition because plant scientists have not yet been able to explain the mechanism by which it functions.

Most of the potassium of plants is found in the foliage and stalk. Harvesting grain, therefore, if the stalk or straw is returned, is not particularly hard on the potassium supply of soils. The grain of the corn crop contains only about one-fourth, of wheat two-sevenths, of oats one-fifth, and of barley one-fourth the total potassium of the whole crop. As the crop matures, much of the potassium returns to the soil either by translocation or by leaching from the foliage into the soil. Corn, oats, and barley in the green forage stage contain two to four times as much potassium as after the crop matures. Removing the entire green growth, therefore, is relatively hard on land.

When feed is consumed by animals, most of the potassium is eliminated and may be returned to the land. Two-thirds of the potassium is in the liquid manure, therefore use of plenty of bedding conserves potassium as well as nitrogen and other important nutrients. Return of well-preserved stable manure is an effective means of renewing the supply of available potassium in soils. Sale of livestock or animal products from the farm for the most part takes off relatively little potassium. Therefore, with good farm management practices the drain upon the potassium supply of the soil should be relatively light. Sale of feed, particularly legume hays, would rapidly exhaust the supply of available potassium in the soil, but such practices are not recommended.

The chief drain upon the supply of available potassium in the soil is probably leaching, the age-old process that never fails to function when there is sufficient rainfall. This loss can be reduced to a low level, however, where

there is a dense sod or vigorous cover crop to absorb the soluble potassium before leaching occurs. The cover crop worked into the soil as a green manure relatively rich in potassium is an effective means of maintaining the circulating supply of available potassium at a high level. Legumes are especially valuable for this purpose, as well as for their more commonly accepted function of nitrogen and humus renewal.

Loss of potassium on grazed areas probably is less serious than where crops are harvested and the soil is left bare for a portion of the season. Lipman estimates the leaching loss of potassium per acre under biennial and perennial crops at little more than half that under the intertilled crops. However, the same author places leaching losses from both crop and pasture lands together at considerably above the total rate of potassium renewal from all sources including fertilizers, or additions of 5,151,076 tons compared to losses of 8,300,000 tons.

The importance of maintaining potassium in an available form in the soil may be indicated by a few figures. The lowest potassium content for 58 western Oregon hill soils was 7,200 lbs. per acre in the plowed depth. Clover hay yielding four tons of growth per acre yearly would require about 136 lbs. of potassium, or the 7,200 lbs. are sufficient for more than 50 crops if it could be made available; and there is just as much potassium in each succeeding layer of soil to be made available for crop production. The entire root zone would probably represent several feet of soil, in all of which some potassium would be accessible. The average potassium content for all the soils was three times this amount. The availability problem, therefore, is a paramount issue so far as the potassium nutrition of plants is concerned.

On potassium-deficient soils use of commercial forms is essential, and a common practice in many areas. Most of the fertilizer used in Oregon goes on truck crops, small fruits, and other specialized crops where liberal and complete fertilization is becoming imperative. For orchards, fertilization of the cover crop for humus renewal is the recommended practice. On most soils, the non-legume cover crop responds to nitrogen and phosphorus with a probable response to sulfur as well as phosphorus on legumes. The effectiveness of the cover crop in providing active humus and liberating potassium and other essential nutrients has helped to establish this desirable practice in many Oregon orchards.

The Effect of Liming Materials Upon the Solubility of Potassium Compounds in the Soil

(*From page* 12)

The percentage retention was greater for the lighter rates of potash addition. Apparently, the marked increase in the concentration of potassium salts resultant from the 4-fold treatment overcame to some extent the capacity of the light liming treatments to diminish the leaching of potassium.

In the foregoing experiments, the several liming materials were used at rational economic rates. Additional experiments have been conducted with a Cumberland silt loam over a 26-year period, during which it has been possible to register the effects of incorporations of seven liming materials at heavy rates. These seven materials were burnt lime, magnesia, precipitated calcium carbonate (corresponding to marl), magnesium carbonate, 100-mesh limestone, 100-mesh dolomite, and 100-mesh magnesite (the mineral carbonate

of magnesium). Each of these materials was used at three rates, 8-tons, 32-tons, and 100-ton equivalences of CaO, or burnt lime. In one series the amounts represent the potassium leached from the surface soil alone. In a parallel series, the leachings from the same surface soil passed through an underlying one-foot depth of red clay subsoil.

The data of table 7 show the respective disparities between the larger amount of potassium leached from the unlimed soil and the smaller amounts that were leached from the same soil plus any one of the several liming materials during the 26-year period subsequent to the single incorporation of those materials. These figures show that each of the seven liming materials caused a substantial diminution in the amount of potassium leached. The range of the repressive effect was between a minimum of 76 pounds and a maximum of 141 pounds. These effects were registered by a soil that is fairly well supplied with mineral forms of potassium, although its supply of available or exchangeable K has been depleted. The amounts of K leached per acre per annum, therefore, are small, approximately 10 pounds.

The second line of values in table 7 shows the disparities between the outgo of K from unlimed soil plus subsoil, and limed soil plus unlimed subsoil. In these comparisons, the excessive quantities of the incorporated liming materials imparted a high concentration of either calcium or magnesium bicarbonate to the rainwater leachings, and these enriched leachings from the limed surface soil caused in the subsoil the same repressive effect upon the outgo of K as that which had been brought about in the upper limed zone.

This brings up a point that should be stressed. The repressive effect of rational incorporations of liming materials upon the solubility of soil potash is limited to the zone of incorporation. For example, if an eight-inch depth of soil is limed in the upper half, the effect of the added liming material in that half of the soil is different from the effect induced in the lower unlimed half of the soil. The neutral salts generated in the upper limed half are capable of bringing about some liberation of potassium in the lower unlimed zone. When a preponderant incidence of the soluble salts of one element induces such a liberation, the phenomenon is referred to as base exchange.

In field soils, however, the actual exchange amounts to a small fraction of the potential capacity of the neutral salts to effect the liberative reaction. In contrast, the expression "reciprocal repression" is used to connote the repressive effect of basic forms of calcic and magnesic materials upon each other and to connote the fact that base exchange does not take place in the zone wherein the liming materials are incorporated. The term "reciprocal repression" was intended primarily to register the parallel phenomena as to the repressive effect of additive high-calcic liming materials upon the leachability of native supplies of magnesia and the reverse effect of additive high-magnesic materials upon the outgo of the native supplies of calcium.

The long-continued experiments at the Tennessee Station have shown that heavy additions of any type of liming material will exert a repressive effect upon the solubility of the potassium content of the limed zone of the soil. A high-calcic liming material may cause a decrease in the solubility of both the potassium and the magnesium content of the soil, whereas an added magnesic liming material will cause a decrease in the solubility of the soil's content of both potassium and calcium. Dolomite and limestone exert the same effect upon soil potash. The overall effect of dolomitic limestone in comparison with limestone in resultant proportions of Ca and Mg in the rainwater leachings is, however, a separate problem that cannot be dwelt upon here.

Experiments have shown that these

several repressions in solubilities are registered definitely by the composition of the plant ash. Certain plant culture studies with tobacco, alfalfa, and wheat have shown that liming may diminish the K content of the plants. Progressive increases in soil incorporations of either ordinary limestone or dolomite or their oxide derivatives will affect materially the percentage of potassium that will occur in the plant.

It is far from the purpose of this paper to give a black-eye to liming. Nevertheless, it can be stated conservatively that a soil liming tends to create a potash problem. Interpretation of the many results over an extended period indicates that the lower the soil's content of potassium in the readily available form, the greater the probability that liming will induce a chemically determinable effect upon the solubility of that potassium content and will exert a definite effect upon the plant growth and incidence of symptoms of potassium deficiency.

It is to be stressed, however, that the indications as to the effect of liming upon potassium availability have been noted for tap-rooted plants and those of limited root development—corn, tobacco, and grain crops. It is yet to be demonstrated that liming diminishes the uptake of potassium by clovers and other lime-loving plants of extensive root development.

How Rotation Paid in North Carolina

(*From page* 7)

Lespedeza on land adjoining the Fryar Farm. This land is unlimed and poorly fertilized. Note prevalence of weeds.

Heavy growth of lespedeza on the Fryar Farm. This land has been well limed and well fertilized.

of phosphate sufficient for the other crops.

The lespedeza also supplies most of the nitrogen for the corn crop which follows it. For several years about 150 pounds of 3-10-10 have been put in when the corn is planted. Since the Iredell type of soil is one of the lowest Piedmont types in potash content, the corn is top-dressed with 50 pounds of muriate of potash.

In 1941 Max proved that the top-dresser pays by putting on a little experiment. He left it off of eight rows, and on those rows much of the corn fell down. An examination of these weak stalks revealed rusty nodes, a sure sign of potash deficiency.

The next crop, soybeans, received an average of 150 lbs. of 3-10-10. The small grain got about 200 lbs. of 3-10-10 at planting, and 50 lbs. of muriate of potash the following spring. No doubt the superphosphate, applied for lespedeza, also benefited the small grain.

Wartime fertilizer regulations forced some modification for 1943; but, so far, above-normal cross of small grain and of soybean hay have been harvested, and

both the corn and lespedeza look good.

The cash income from this farm, with 58 acres of cropland, comes chiefly from 3.5 acres of tobacco, lespedeza seed, milk, and curb-market sales. It amounts roughly to $4,000 per year.

Corn falling down where top-dresser of 50 pounds of muriate of potash per acre was omitted in 1941. Yield of corn where top-dressed, 55 bu. per acre.

Kudzu Conserves Southern Soils

(*From page* 26)

Survival of green plants has averaged approximately 50 per cent. The same type of small crowns may be dug and planted as dormant plants early in the spring before growth begins. This method is important because it allows a farmer to dig crowns for additional acreage before his first planting establishes a complete stand. Crowns for additional acreage may be dug the second growing season, provided kudzu is given proper soil preparation, fertilization, and cultivation the first year.

Clean cultivation during the first growing season probably has been the most important single factor in the rapid establishment of a stand of kudzu. Most satisfactory growth has been obtained where cultivation was started early in the spring and continued until a ground cover was established along the rows. With rows spaced as much as 25 feet apart, the labor required per acre for clean cultivation has been relatively low, particularly if cultivation was started early in the spring before grass and weeds got a start. Corn or another row crop planted in the wide middles between kudzu rows the first and second years reduced the cost of weed control.

Where good treatment was given the first year, complete ground coverage has sometimes been made by the end of the first growing season so that planting a cultivated crop between the kudzu rows the second year was not necessary. Where only a few scattered plants were

established between the rows the first season, planting a cultivated crop in the middles the second year hastened the establishment of a stand.

After a good stand of kudzu is established, it will last many years without replanting, if it is managed properly.

Kudzu requires fertilizer treatment for maintenance. Phosphate is required on practically all soils in the South. Potash is needed on soils where cotton and other crops respond well to applications of this element. Kudzu has not been grown as a forage crop long enough to enable agricultural experiment stations to determine its exact fertilizer requirements, but experience of farmers has shown very definitely that it must be fertilized. Farmers usually have applied approximately 600 pounds of superphosphate per acre and disked it into the soil at the beginning of the third growing season, and once every three years thereafter. Where potash was considered necessary, 100 pounds of muriate of potash per acre usually were applied with the phosphate.

No outstanding results have been obtained from applications of lime for kudzu. It is possible that moderate applications of lime will be necessary after kudzu has been grown on a field and been harvested for hay for several years. Further experience will be necessary before definite liming recommendations are made.

Kudzu has grown well on most well-drained upland soils with crumbly subsoils. It has not grown satisfactorily on the heavy soils of the Black Belt of Alabama and Mississippi, nor on poorly drained soils. Kudzu fails to make good growth on soils underlain by plastic, gummy subsoils and on those that are usually referred to locally as "cold" soils. As an example, in north Mississippi and west Tennessee, kudzu has not grown well on brown loams that were underlain by yellow, poorly drained subsoil material, but has grown vigorously on similar topsoils underlain by red, crumbly subsoils or by deep sand. On deep, poor sandy soils, kudzu requires liberal applications of fertilizer to establish a stand.

Kudzu has gone a long way since it was introduced in 1876. It has definitely come down off the front porch and gone to work in the field. Already it is doing near wonders as an erosion-resisting ground cover under a range of conditions extending from drainage canal banks in the Mississippi Delta to steep hillsides of the Blue Ridge. It is healing gullies and restoring the productivity of slopes that farmers wore out in a vain effort to make money with cotton. These scarred slopes are coming back into a new type of production that is destined to have a vital part in turning the South toward an agriculture in which cotton, grazing crops, and livestock will be teamed up to give people a better living, and in which wise use will replace extravagant waste of land.

Antidotes

(*From page* 5)

maybe this is the real answer to home morale and a godsend to stiffen the resistance of the overseas armies—more gaudy comics and wonder boys afoot and horseback! If so, then I shall be content to starve my editorial ego and cramp my swinging style. This is a time to ration ourselves to the bare essentials, remember — providing we have sense enough to know what they are!

This being Thanksgiving season and the ante-room time of the holiday season as well, one might imagine that a good and thoroughly sane way to combat war-time sluggishness would be to forget everything and eat hearty. My friends, such was possible under ordi-

nary conditions and circumstances. In my well-fed memories, I recall scores of occasions when a tasty roast flanked by plenty of succulent sundries, and maybe a nip before and a couple afterwards, would give me gastric release from the world's problems. Remember those by-gone festivals around the replenished larder with hallowed regrets! Indeed they did bolster one from the carking cares of humdrum life and bestir the imagination with the aroma of turkey dressing, cranberry sauce, giblet gravy, cheese souffle, mince pie, and brimming flagons of egg-nog. Moreover, they induced the potent sleep of forgetfulness for all your wife's relations who never remembered to bring anything substantial except their appetites.

However, the shadow of the OPA and the manifold obligations entailed in the dwindling blue and brown coupons in your family ration books combine to make meal time a lugubrious interlude, and the preparation of a sandwich snack something horrible to contemplate for the housewife. It can almost be said with resignation that neither one of the alternatives remain true—you don't live to eat and you seldom eat to live!

OF course, for a brief interval during your food-hunting tours of depleted emporiums, cluttered up with point markers, you and the Missus can forget the fighting abroad long enough to fight with figures here. Many times I have toted goods up to the cashier only to be told with scorn that the stuff was frozen, although it didn't look like it on the shelves. Or be reminded that your stock of trading points could not possibly be stretched to cover the edibles in question, much as they realized your apparent need of vitamins and fats. I used to enjoy going into groceries and butcher joints with my faithful and provident companion of many menus, sniffing approvingly at the delectables and pinching the pumpkins. Nowadays I accompany her only because my addition and subtraction is somewhat better than hers, and not because the load we take from thence is too heavy for her to carry. I am opposed to mixing algebra with appetites, but suppose it can be made into a kind of relaxing pastime until the farmers once more have to wrestle with a surplus. By that time my teeth will fail me and my liver will be in no mood for arbitration, so that the cornucopia of the post-war period will probably dump its delicacies for me in vain. I hate to depend on corn flakes and dried skim milk even for a chance to glory in the capture of Hitler.

THEN when all else fails, there remains hunting and fishing. Both have the undeniable extra urge of going to nature for things you can't get from the government! But for an indoor athlete like me, neither sport has charms like a ready-made repast. I was never a nimrod or a follower of the fox and hounds, or one to tear my pants climbing over a farmer's fence after rabbit stew.

But I finally weakened and permitted myself to be sold on the idea of going fishing with two veteran anglers. After going through the serious and competitive negotiations of renting a boat, we started to get the lunch and tackle geared. Ralph suddenly told us he had dropped the worm box overboard. He had a few stray ones in his vest pocket, so we proceeded to a certain marked spot in the lake. By some uncanny method of reckoning, Ralph and Ed finally said they had arrived on the location. Before they got well started on the fishing business both got hungry and I passed out war-time meatless sandwiches. Just as Ralph took a big bite the fish did too and he called out lustily for someone to help him handle both. He almost got the fish mixed up raw with his sandwich, but at last the pickerel was in the boat. But this was the only fish willing to join us, and toward dark they told me to row them to the shore. I kept heave-ho-ing

for fifteen minutes without reaching the much desired haven, when Ed reached down over the side and pulled up the anchor. I then lit out with aplomb and bent to the oars with alacrity, only to end up with the prow in a mud bank surrounded by dank water and bull frogs. After they dubbed me "Commodore" and thanked me for the ride, I stumbled homeward with the scales lifted from my eyes and my fins weary from well-doing.

IF one becomes still more bored and desperate over wars and rumors of longer wars, he can take the last bitter resort of the times and volunteer for a few days' toil amid the pleasures of farm life at harvest. Or alternate that solemn obligation with a fling at being a clerk in the local ration board office. Either task will temporarily deprive a normal man of any longings beyond that of a soft bed.

I lasted longer than the dairyman imagined I could. I stayed out there two days. They seemed longer however. I never fully appreciated how much activity and loss of nature's sweet restorer it takes to deliver a paltry four hundred pounds of 3.5 per cent milk without spilling or spoiling it. I got so imbued with inertia and the aroma of ammonia around the cow barn that I was in a trance for a week afterward. I thanked the rural custom of feeding a bull at the other end of a pitch fork. Hand feeding stops, they tell me, when the bovine of that sex gets too heavy to lift. My wrists got so numb from milking one cow while the boss emptied the udders of seventeen that I had to drink my coffee with a straw, and I couldn't button my overalls. Finally, the food chief in charge of the herd phoned to the draft board for a couple of conscientious objectors to take my place on the lacteal line. He said he was losing time and money having me around and offered to get me a job on the road crew, if they could get priority on a new shovel for me to lean on. And that was that.

It was even worse over at the ration board, where the slogan was "My country right or wrong, blame it on the bureaucrats." Half the applications I put my semi-official O. K. on were sent back for corrections because I couldn't understand the legal handbooks the OPA man gave me to study. But there was a certain gratifying sense of federal power vouchsafed me when I cut the A and B books out from under a slick neighbor of mine, who had bragged too much in my hearing about his hornswaggling Uncle Sam. Thus we do get compensations out of arduous duties sometimes.

Finally when everything else fails as surcease from war-time miseries, one can always take sides in a verbal scrap in your own bailiwick over the travels of Eleanor or the degree of reliance we can put on Russia, the fourth term or the fifth column.

THERE was a happy time before the war when I had no manly ambitions to excel as a table thumper, a brow-beater, and a die-hard stand-patter; and when my replies were of the sacred "yea and nay" order. But I have learned under war's stresses that citizens need not lack for belligerent pugnacity even without uniforms as protection. I can now take two sides of the same question, an hour apart, and froth at the mouth just as venomously if my adversary is provocative enough. I get lots of such fine exercise to while away the tedious hours, because even my mildest neighbors can be stirred into purple rages on public scandals and private peeves. If I can keep it up long enough, maybe I'll get a nice hospital vacation and take up some of that company insurance.

It all adds up to what I intended to say at first without so much explanation—to wit, that antidotes are often worse than the poison itself.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
CC-8 How I Control Black-spot
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
DD-9 Some Fundamentals of Soil Management
KK-9 Florida Studies Celery Plant-food Needs
MM-9 Fertilizing Tomatoes in Virginia
UU-9 Oregon Beets and Celery Need Boron
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
CC-10-40 Building Better Soils
A-1-41 Better Pastures in North Alabama
E-2-41 Use Boron and Potash for Better Alfalfa
K-4-41 The Nutrition of Muck Crops
U-8-41 The Effect of Borax on Spinach and Sugar Beets
Z-9-41 Grassland Farming in New England
BB-11-41 Why Soybeans Should Be Fertilized
EE-11-41 Cane Fruit Responds to High Potash
HH-12-41 Some Newer Ideas on Orchard Fertility
II-12-41 Plant Symptoms Show Need for Potash
B-1-42 Growing Ladino Clover in the Northeast
D-2-42 Boron Deficiency on Long Island
E-2-42 Fertilizing for More and Better Vegetables
F-2-42 Prune Trees Need Plenty of Potash
G-3-42 More Legumes for Ontario Mean More Cheese for Britain
H-3-42 Legumes Are Essential to Sound Agriculture
I-3-42 High-grade Fertilizers Are More Profitable
P-5-42 Purpose and Function of Soil Tests
Q-5-42 Potash Extends the Life of Clover Stands
S-6-42 A Comparison of Boron Deficiency Symptoms and Potash Leafhopper Injury on Alfalfa
T-6-42 The Fertilization of Pastures and Legumes
X-8-42 Conserve Nitrogen Now
Y-8-42 The Southeast Can Grow Clover and Alfalfa
Z-8-42 The One-Mule Farmer Needs a New Machine
AA-10-42 Growing Legumes for Nitrogen
BB-10-42 Insuring Success With Indiana Sweets
CC-10-42 Managing Mucks Includes Control of Blowing
DD-10-42 Clover Pastures for the Coastal Plains
EE-11-42 Lespedeza Pastures for Florida
FF-11-42 Boron in Agriculture
GG-11-42 Some Experiences in Applying Fertilizer
HH-11-42 The Nutrition of the Corn Plant
II-12-42 Wartime Contribution of the American Potash Industry
JJ-12-42 The Place of Boron in Growing Truck
A-1-43 The Salt That Nearly Lost a War
B-1-43 Crotalaria—A Crop That Grows Like Weeds
C-1-43 Quality in Grasses for Pasture and Hay
D-1-43 For Hershey Orchards—Complete Fertilizer
E-1-43 Borax for Alfalfa in Tennessee
F-1-43 Boron Improves Canning Beets
G-1-43 Plow-Sole Fertilizers Make Good Showing
H-2-43 Plant Food for Peach Profits
J-2-43 Maintaining Fertility When Growing Peanuts
K-2-43 Feeding Minerals By Way of the Soil
L-2-43 Victory Gardeners Produce & Preserve
M-3-43 Lespedeza Is Not A Poor Land Crop
N-3-43 Boron and Potash for Alfalfa in the Northeast
O-3-43 Indirect Nitrogen Fertilization
P-3-43 Ohio Farmers Try Plow-Under Fertilizers
Q-3-43 Winning the Battle for the Land
R-3-43 More Smokes Per Acre
S-4-43 Plow-Sole Fertilizers Benefit Tomatoes
T-4-43 Fertilizing Tung Trees by Leaf Analysis
V-4-43 Permanent Pastures Need Help
W-4-43 The Soil Is the Basis of Farming Business
X-5-43 Malnutrition Symptoms & Plant Tissue Tests of Vegetable Crops
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
Z-5-43 Poultry Manure—Source of Nitrogen
AA-5-43 Can Legumes Be Over-Emphasized?
BB-6-43 Sericea Is A Good Crop
CC-6-43 Putting Fertilizer Down Puts Crops Up
DD-6-43 Salt With Potash for Some Crops
EE-8-43 Pastures—That Come to Stay
FF-8-43 Potash for Citrus Crops in California
GG-8-43 Why Do Farmers Plow?
HH-8-43 More Soybeans, Please!

THE AMERICAN POTASH INSTITUTE

1155 16TH STREET, N. W. **WASHINGTON 6, D. C.**

Have You seen the Motion Picture

PLANT FOOD FROM COAL

● MILLIONS of years ago, prehistoric forests gathered Nitrogen as they grew. Today this Nitrogen is recovered from coal by modern coke and gas plants as by-product *Domestic* Sulphate of Ammonia. The manufacture of *Domestic* Sulphate of Ammonia and its use as a plant food are graphically portrayed in the 16 mm. sound and color motion picture "Plant Food from Coal." This film, with a running time of 39 minutes, is available for educational use. For information, communicate with:

Educational and Research Bureau for By-Product Ammonia
50 West Broad Street, Columbus 15, Ohio

Free! This handsomely-illustrated 24-page booklet is based on the film and is filled with full-color pictures taken from the film. *It is yours for the asking!*

AN INSCRIPTION ON THE TOMBSTONE OF AN ARMY MULE NAMED MAGGIE

"In memory of Maggie, who in her lifetime kicked 1 General, 4 Colonels, 2 Majors, 10 Captains, 24 Lieutenants, 42 Sergeants, 454 Privates, and one bomb."

Cholly: "Pa, what's a bigamist?"

Pa: "A bigamist, son, is a guy with enough nerve to outtalk two women."

"Every time Johnny's wife has a baby, he buys a new accessory for the baby buggy. First it was a new top, then new bumpers, then some fenders, then a pair of wind wings, and finally a new set of tires. Now they've got another baby and Johnny is stuck. He doesn't know what else to buy for the buggy."

"I think he ought to get a stop light."

FAIR WARNING

"My advice to women war workers is, if the sweater is too big for you, look out for the machines. If you're too big for the sweater, look out for the men!"

Mother: "What is the matter, darling?"

Child: "Father hit his finger with the hammer."

Mother: "Don't cry about it; you should laugh."

Child: "I di-did."

Women never tire of redecorating rooms or reforming men.

Mother to Daughter: "I don't want you to marry. I've seen the folly of it."

Daughter: "But, Mother, I want to see the folly of it, too!"

HERCULEAN TASK

Student: "I hear the Board of Trustees is trying to stop necking."

Second Student: "That's so? First thing you know they'll be trying to make the students stop, too."

"I don't need none!" said the lady of the house before the agent had opened his mouth.

"How do you know? I might be selling grammars."

PROPOSAL

"Jim proposed to me last night and I'm sore at him."

"What makes you so mad?"

"You ought to have heard what he proposed."

A darky soldier's definition of morale —"The thing that keeps yo feet goin' when yo haid says it cain't be done."

ABSENT MINDED

"Imagine my embarrassment," said Dumb Dora, "when, according to my usual custom, I looked under the bed before retiring. I had forgotten that I was in an upper berth."

A man's mental age can be accurately measured by the degree of pain he feels as he comes in contact with a new idea.—*The Ambassador.*

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.

Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.

PACIFIC COAST BORAX COMPANY

NEW YORK CHICAGO LOS ANGELES

BORAX

for agriculture

20 Mule Team. Reg. U. S. Pat. Off.

MOTION PICTURES

EDUCATIONAL FILMS AVAILABLE

Save That Soil

A 16mm., sound, color film depicting the early South, the results of the one-crop system, and the reclamation and conservation of Southern soils through the use of legumes and modern methods of soil management. ***Running time, 28 min. (on 1200-ft. reel).***

Other 16MM. COLOR FILMS AVAILABLE

Potash in Southern Agriculture
In the Clover
Bringing Citrus Quality to Market
Machine Placement of Fertilizer
Ladino Clover Pastures
Potash from Soil to Plant
Potash Deficiency in Grapes and Prunes
New Soils from Old
Potash Production in America

We shall be pleased to loan any of these films to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible) and period of time of loan.

For additional information write:

AMERICAN POTASH INSTITUTE, INC.

1155 Sixteenth Street **Washington 6, D. C.**

INCREASE YIELDS AND STANDS

Treat Seeds with

Spergon

REG. U. S. PAT. OFF.

The Seed Protectant that prevents seed decay

Impartial Experiment Station tests prove that vegetable seeds treated with Spergon increase yields as much as 30% over untreated seeds. Growers report excellent increases in stands and yields. This outstanding seed protectant has a number of advantages that make it most desirable from a profit and utility standpoint. Spergon works in any type of soil. It is safer, easier to use and surer; longer lasting, self-lubricating in drills, compatible with inoculation and economical. For further information and distributors' names, write

UNITED STATES RUBBER COMPANY

Naugatuck Chemical Division, 1230 Sixth Ave., New York, N. Y.

POTASH IN NORTH AMERICA

By J. W. TURRENTINE

President American Potash Institute

AMERICAN CHEMICAL SOCIETY MONOGRAPH NO. 91

• • •

AMONG American chemical industries that have attracted national and international attention due to their war-emergency performance, few have exceeded the American potash industry.

This interesting and well-written survey of the development of the American potash industry during the last fifteen years is particularly important at the present time, when the food problem is second in importance only to the war itself. After a brief review of the present sources of potash, complete details are given as to production, both domestic and foreign; present status of the industry; and its future prospects. Special attention is accorded to Carlsbad, N. M., and Searles Lake, Calif., developments, and to the fundamental technology of potash. This important volume has been made unusually attractive by the inclusion of a large number of exceptionally good photographs of all phases of the industry.

Dr. Turrentine, of the American Potash Institute, is one of the country's leading authorities in this field. His work will be welcomed as a most significant addition to the literature of the subject by all who are interested in any way in the production and use of potash and related products. This book will be required by public libraries, as it is the only source of reliable information on the current status of this vital resource.

•

CHAPTERS

Introduction: Fifteen Years in Review
The Uses of Potash in American Industries
Technology of Potash Production
Conclusion

186 Pages . . . Illustrated . . . $3.50

REINHOLD PUBLISHING CORPORATION

330 West 42nd Street, New York, N. Y.

Printed in U.S.A.